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BRIEFLY TOLD.

PRESIDENT COPLEY'S ADDRESS.—This issue of the JOURNAL carries the first instalment of the official report of the proceedings of the 24th annual meeting of the Western Gas Association, held at Louisville, Ky., on the appointed days. The chief happenings of the sessions were reported briefly last week; and, while our telegraphic correspondence shows that the meeting was a good one, the same correspondence proves anew that water and oil will not mix in Kentucky any more than that the named ingredients will be mixable in New York, Massachusetts, Ohio, Colorado, Texas or California. Whose fault it was that there was not better communion must be determined by the gentlemen who had the naming of the local committee. Still, despite the local incongruities, no matter who was responsible for them, it is a fact that the Western's Louisville meeting proved anew that it may be depended upon to always have something good in store for those who assist it from a technical standpoint. One thing that was good, and right good, in such respect, was the address by President Copley. It is fully reported in our current number, and we have much satisfaction in saying that it will rank, in interest and worth, at least with any other address delivered before any American Gas Association. He in it claims not too much, proclaims himself not unreasonably for the interest which he so cleverly represents, and in the end well declares (see the last paragraph of his address) himself of the faith, with reason, that is in him. Look over, read and study the main paragraphs of his Louisville speech as you will, the conclusion must come that those of little faith in gas trading should revise their creeds, especially if their first instruction in the art of supplying lighting mediums from central stations was concerned with electric currents. New York city and Cincinnati have, so far, proved this statement; the next in line to experience the instruction will be Boston, Mass.; St. Louis, Mo.; Philadelphia, Pa.; and Washington, D. C. These, of course, are of the large order specimens. The lesson has been taught to many of the smaller experimenters years ago; for that one electric company's success, in securing control of the respective central lighting of any place, unless a very profitable deal to the gas end was obtained, has been overmatched by nine contrary instances. That is to say, the nine electric sellers were purchased by the nine gas buyers, with the terms quite at the estimating of the latter. President Copley's address will bear study and studying; and, young as he is, no matter how old he will become, he will never be old enough to put out better advice than is contained in the sentences of his concluding paragraph, amongst which read: "In other words, we must strive to perfect ourselves from a technical standpoint to produce our product as economically as possible, and, from a business standpoint, to sell it as economically as possible." The address is in every sense worthy of the acknowledged ability and cleverness of the gentleman who prepared it.

MR. STEINWEDELL'S PAPER.—Another chapter of our current instalment of the Western's Louisville meeting, that will be read with interest, and that can be studied with profit, is in the paper by Mr. W. E. Steinwedell, of Belleville, Ills., the specific title of which is, "Recuperative Furnaces of To-day: Directions for Operating and Testing." Nor does the text belie the title, for the author, in perfectly clear method, manner and wording, told his story in such a simple way

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that, at least so it seems to us, if he choose, he could knock out one text book on the subject, did he see fit to publish the paper between book shop bindings. Mr. Steinwedell's tutelage, gained at the start under the advice of Mr. A. C. Littleton at home and later on under the guidance of M. von Oechelhaeuser abroad, does not seem to have caused any abnormal growth close to his hat, which goes to show that some of the sons have in them the stuff of which their fathers were made. The discussion over the paper was about as equally interesting as the matter which prompted the debate. Mr. Somerville's querulous suggestion brought out a good rejoinder from Mr. Forstall, and both should be amusing (in fact, Mr. Forstall must have smiled a trifle inwardly over the matter) to those who have tried to get along with negro labor in the operating of gas works in sections of this country where you cannot employ labor of any other color, unless the price or cost of the "other color" is prohibitive—either from a coal or water gas standpoint. The Steinwedell paper was brought to an end by a temperate reply from its author to the queries brought out in the discussion; and, in the lines spoken by Mr. Egner in the debate, we may say with him that Mr. Steinwedell is to be complimented on the way in which he thought out, formulated and "acquitted himself of his task." In conclusion we think Mr. Steinwedell should make a book of his story.

NOTES.—Mr. John A. Van Zelm, a lawyer of more or less repute, has appealed to the authorities of New Rochelle, N. Y., for the right to enable the Domestic Gas Company to lay pipes for the distribution of gas through "North street and in the outlying territory where no gas is at present supplied." Are Messrs. Fiske & Company not satisfied?——Messrs. James S. Berry, W. L. Jones, W. S. Schaefer, M. P. Schantz and Guy E. Jones have made application for a charter for the operation of a company, to be known as the Alliance Gas Company, in the Borough of Alliance, Northampton county, Pa.——A correspondent forwards the following, under date, of May 19th from Reading, Pa.: "The stove department of the Consumers Gas Company, of this city, started a novel scheme some days ago to bring gas stoves to the attention of the public. A wagon, 12 feet long and 6 feet wide, handsomely painted in yellow and white, and having on board two sizes of stoves, was started out on a tour of the city. Streamers and banners call attention to the Company's products, and Mr. Albert Schaefer, the well known cornetist accompanied the outfit, rendering cornet solos along the way. The wagon, which is in charge of Mr. Theodore Keppelman, Manager of the Company's stove department, directed the proceedings. It is a cooking and gas stove instruction on wheels, and its purpose of course is to give information to prospective users of such appliances."

A New Incandescent Street Lamp Lighter.

The *Journal of Gas Lighting* notes that a new igniting device for attachment to incandescent street lamps has been brought out by Messrs. H. Greene and Sons, Limited, of No. 19 Farringdon Road, London. Its chief merits are that it is simple, that it is rapid in action, that an ordinary torch may be used, that the torch is not brought nearer the mantle than the frog of the lantern, and that consequently no flap door is required in the bottom of the latter for lighting purposes. On the supply pipe just beneath the burner cock is inserted a plug cock, from which issues the gas for the supply of the lighting arrangement. The opening and closing of this plug cock is controlled by a weighted lever, above which a spring is also provided to insure the rapid shutting off of the gas supply on the ignition of the lamp being completed. The weighted end of the lever is inclosed in a cylindrical casing, with its bottom end open, and which casing is affixed to the frog of the lantern. At the top of the cylinder, and connected with the plug cock, is a small coil of copper tubing containing a row of perforations, and this perforated tubing is continued up within the lantern to a slightly higher level than the top of the mantle or mantles. Now assuming the tap supplying the burner has been turned on, the insertion of the lamplighter's torch in the cylindrical casing lifts the weighted lever, and gas is simultaneously admitted to the coil, and is at once ignited. With a run the small jets of gas issuing from the perforated tube within the lantern also ignite, ending with a jet at the top which shoots an arm of flame over the mantle. On the withdrawal of the torch, the weighted lever drops and closes the gas supply to the lighter. The whole action takes no longer than is required to push the torch up to the top of the cylindrical casing and to withdraw it. In lanterns containing more than one mantle the copper tubing is carried up between them; and in the case of widely spaced clusters small branches are carried out from the tube to within a short distance of the tops of the mantles. The igniter has been adopted at St. Albans and elsewhere.

[OFFICIAL REPORT.—REVISED BY THE SECRETARY.]

PROCEEDINGS, TWENTY-FOURTH ANNUAL MEETING WESTERN GAS ASSOCIATION.

HELD IN THE GALT HOUSE, LOUISVILLE, KY., MAY 15, 16 AND 17, 1901.

FIRST DAY, WEDNESDAY, MAY 15th.—MORNING SESSION.

The Twenty-fourth Annual Meeting of the Western Gas Association was convened in the Galt House, Louisville, Ky., at 10:15 A.M., May 15th, by the President, Mr. Ira C. Copley, of Aurora, Ills. The recording desk was in charge of Mr. James W. Dunbar, of New Albany, Ind.

On motion, the minutes of the previous meeting were not read. Owing to hoarseness, consequent upon a severe cold from which the President was suffering, he asked Mr. Thomas D. Miller, of Dallas, Tex. (First Vice President of the Association), to read the

INAUGURAL ADDRESS.

which Mr. Miller did as follows:

It is a great pleasure for me, in my official capacity, to welcome so many members of the Western Gas Association to its 24th annual convention. The growth of the Association since its organization, with the increased interest in and attendance at its annual meetings, is the best evidence of the value received by the individual members through its medium.

As an Association we were never so strong in membership and never so strong in the interest taken in the Association and its work by the individual members. We have, however, to reckon with an agency that is constantly working to reduce our membership. We have lost in death, during the past year, the following 7 members: James M. Starr, died June 9, 1900; Milton J. Payne, died July 17, 1900; George Treadway Thompson, died Oct. 1, 1900; Herman Wilkiemeyer, died Nov. 20, 1900; D. L. Cathels, died Nov. 21, 1900; Henry Ranshaw, died June 30, 1900; and F. O. Ellsworth, died Jan. 9, 1901.

The usual Committee on Memorials will be appointed and suitable action will be taken to show the esteem in which these gentlemen were held by their co-workers of the Western Gas Association.

It is always in the mind of the committee, in choosing a place of meeting, to decide upon a city that has some particular interest for the members of this Association. This year we have an opportunity of seeing the first practical working of inclined retorts made within the territory embraced by this Association. We shall also have the pleasure of hearing comprehensive and complete data, compiled by a man competent in every particular, who has made this his especial study for several years past, and who now reduces the result of study and practical experiment for our benefit at this meeting.

We have an unusual occasion this year for mutual congratulation. Probably no year has passed since the gas industry was established which has shown such uniform gains in sales and of such large volume as has been shown by the year 1900 just past. The cause of this prosperity lies both without and within ourselves. First: The unprecedented general prosperity of this country has made it possible for the efforts of the various managements of the different gas companies embraced in our territory to secure large and immediate increases in sales and next, the gradual development of the individuals concerned in such respective managements has evolved new and sound ideas in teaching the public how to use our product; and the fact that practically all of our companies have so enormously increased their number of customers and the channels through which these customers use gas, is evidence that, in the event of a halt in the general prosperity of this country, our own industry will continue to reap a satisfactory reward during periods of ordinary depression. The contemplation of this hope has afforded much cause for cheer during the past two years, when many of us have seen the profits that ordinarily would follow increase of sales diverted from our own pockets to the pockets of men who supply us with raw materials.

The near future gives promise of a restoration of normal prices (or approximately normal prices) for our materials, leaving us an immediate measure of benefit from our increased sales, such as many of us may not have shared during the last two years.

We have cause for mutual congratulations over the fact that many of the conditions that threatened serious danger to our business during the past few years have become more familiar as time goes by, and the alarming features have been much reduced by practical experiment against us. I believe no member of this Association who has given the matter careful thought and investigation will believe that his interests stand in any danger from the future development of cheap ca

cium carbide. The disadvantages from the use of acetylene gas by the individual consumer, when compared to the convenience of using gas from a central station, all but entirely preclude its general introduction. Whatever may be its advantages for small villages and for lighting isolated buildings, is no concern of ours.

The incandescent electric lamp, as a competitor, has found no new advantage during the past year, save that of increased prosperity on the part of the consumers, thus allowing them to indulge themselves somewhat in the more expensive luxuries. Its convenience to the user, and its convenience in lending itself to beautiful forms of decoration, are still its only claims for recognition by the purchaser.

When we stop to consider what a small percentage of the population supplied by the industry which we who are here represent, is able to look with careless eyes upon the expenditure of several dollars every year for the conveniences above referred to, we can certainly contemplate the future of competition with incandescent electric lighting with great indifference.

I venture the assertion that, in the average city of more than 10,000 population, at least 40 per cent. of the current used in incandescent electric lighting is used in such a manner, and for such a purpose, that it displaces practically no gas jets.

The one development made in the electric lighting business since the introduction of the incandescent electric lamp itself, which has given us concern and trouble, is that of the inclosed arc lamp; and from its very nature, even if we are unable to compete with it in convenience, we are still able to light business houses much better and more economically with the incandescent gas lamp. The inclosed arc lamp has the same disadvantages of expense and concentration of a large volume of light at a given point as that labored under by the old fashioned form of series arc lamp.

Within the past 2 or 3 years (my own observation has been that the greatest development has been within the last two) a new form of competitor has arisen in the gasoline arc lamp. No careful student can regard the present forms of gasoline lamps designed for lighting living rooms as at all possible as competitors with incandescent gas lighting. This gasoline arc lamp, however, has some advantages over the electric arc lamp—it is much cheaper to run; but it has the same disadvantages over gas in the concentration of light at one point, and it has a still greater disadvantage over both forms of lighting in that its use is attended with much trouble and great danger.

Our oldest competitor is still cutting us out of the sale of more gas for light than is any other. The kerosene lamp, with its economy, and with its hold upon the habits of the past 2 generations, can only be rooted out where the individual user feels himself financially able to avail himself of the greater convenience and greater volume of light furnished by gas.

And yet we are not without a light as soft, as steady and attractive in every way, and much more powerful, in the form of the Welsbach or other incandescent gas reading lamp, and the time to introduce these lamps is now while the prosperity of the consumer leads him to believe himself capable of affording such a delightful luxury.

At present no competitor is in the field to supply kitchen fuel. The many attractive methods of introducing appliances to use gas in this manner, followed by all of the progressive gas companies, will place gas as a fuel (combined with first cost and wear and tear on a stove) above competition with gasoline during a period of 5 or 6 years in the mere matter of economy alone.

It is almost impossible to regard the contest between gas and gasoline as fuel as a competition. The frightful dangers attending the use of the latter, as evidenced by the thousands of accidents (many of them fatal) which are recorded every year in our daily papers, furnish the gas man with an argument which is unanswerable.

I am sure that no words of mine are necessary to spur every man present to do his utmost to completely cover this field, at a time when he is absolutely master of the same. Think for a moment of the enormous expenditure of time, brain, energy and money necessary to completely overturn any established line of business. Then imagine yourself having completely covered the territory tributary to your company with appliances for the use of gas for fuel, and enjoy the prospect of many years' immunity, even after the forthcoming of some possible and, at present, unthought of competitor with real merit back of it! It is not alone during the present that your efforts in this direction will be rewarded, but for many years to come. The contemplation of all of the advantages of this agent as a popular fuel leads me to believe that our work will never be complete until the kitchen of every home within the territory reached by our mains is supplied with a gas range, and the only exception that I will make to this is the hovel which shelters shiftlessness or vice.

While we are congratulating ourselves and each other upon the prosperity of the past few years and the prospect of its continuance, we must at the same time be building our entrenchments and shotting our guns for the dangers that are likely to come. Even if I were sure I knew (which I am not) I could not tell you in one short address why the average man objects to allowing a return on capital invested in our line of business at all proportionate with the same enjoyed by an equal amount invested in any other line—why the average man will not allow business sagacity, energy and work to profit in the line of gas manufacturing and selling to a degree commensurate with that enjoyed by a man furnishing any other great necessity to life. The flour mills may consolidate and demand such prices as they will from the baker. The bakers may consolidate and demand such prices as they choose from the man who buys and eats bread. Individuals and corporations may amass enormous wealth in the sale of meats, but these same consumers of bread and meat insist upon their right to determine what price the gas man shall get for his product, and what rate of interest (if any be allowed) he shall make upon the capital invested in this enterprise. I will admit that the consumer has had many grounds for complaint in the past. I will also offer this statement that any one of us here who has been a user of the product of the baker, butcher, the cotton factor or the ironmonger, can rake up from the history of the past generation just as great injustices, just as many instances of lack of foresight and business acumen as can be charged against our business. The fact is, the world of business has moved on, and we have certainly moved apace with our fellow workers, engaged in whatever line they may be.

It seems to be a general trait of human nature that each of us should notice all of the advantages enjoyed by his neighbor while we do not notice the disadvantages. It may be that periods of general business depression have done us harm through prejudicing the public mind, for the reason that by the very conservative nature of our business most of us were able to show earnings at a time when the majority of our neighbors were either getting no profit from their labors, or, in many instances, were suffering a loss. Whatever may be the cause, the fact remains that the last few years have seen an enormous growth of a sentiment in favor of municipal ownership of all public utilities. I am optimist enough to believe that the same few years have seen some improvement in the ability of municipalities to furnish the citizens the services now furnished by quasi-public corporations. I do not believe that any man short of a dreamer can think that this world has yet reached a point where a business, managed by men who have no financial interest whatever in the results of management, can possibly obtain the same economies as when the meat and bread of some man, and those who are dearer to him than himself, depend absolutely upon his securing such economies of result.

Municipal ownership means a menace to vested rights. A public, blinded by passion, or self intoxicated by the possibilities of its own potentialities, may pay us the full values invested in our lines of business, and it may not. It means to those of you who are engineers that you must be able to control a certain number of votes or give way to some other man who can. It means to those of you who are managers or superintendents that your time must be spent, not in perfecting yourselves in the development of your profession, but in developing your political acumen so that you can recognize which element is likely to win, early enough to enable you to have a front seat in the band wagon. It means to the men who at present do the labor, and whose frugal savings are providing education and homes for their dear ones, that their leisure hours must be spent in keeping the small cogs of the local machine well oiled, and it means that the municipality itself will be worse and more extravagantly served, even though the burden of this extravagance may be taken from the shoulders of the consumer and added to the shoulders of the taxpayer.

I hope, and I think I can detect a lull in the general tendeney that has been sweeping in this direction; it may be only a lull—it may be the beginning of a reaction. Our course is the same in either event. First: We must stand firm on the principle that our interests and the interests of our consumers are identical; second, that capital engaged in our business is entitled to its legitimate business profits; third, if we are allowed only the rate of interest at which money can be loaned on first-class real estate or collateral security, no capital would be foolish enough to engage in a gas enterprise with its hazards and its worries; fourth, we must see to it that the character of our service is above the reproach of any careful, conservative, fair minded man; fifth, we must see to it that our business is honestly managed. We must be

honest with ourselves. Our capital must not represent inflation, but the actual expenditure of money which goes to make up permanent betterments, improvements and extensions; and last, we must see to it that our profits are not too large, lest they ultimately be taken away from us entirely. In other words, we must strive to perfect ourselves from a technical standpoint to produce our product as economically as possible, and, from a business standpoint, to sell it as economically and well as possible. Our salvation from this danger, it seems to me, lies entirely within ourselves. If we conduct our business in all its details in such a manner as we ought, I have every hope that, when the muuicipality reaches a point where it is truly able to manage its own utilities, it will feel it has no need to take them from our hands.

On motion of the Secretary the address was referred, for consideration and report, to a committee consisting of Messrs. E. G. Pratt, Jas. Ferrier and Geo. G. Ramsdell.

Appointment of Special Committees.

The President named the following special committeemen:

On Memorials.—Messrs. Paul Doty, E. G. Cowdery and James Somerville.

On Final Resolutions.—Messrs. James T. Lynn, John Gimper and W. H. Odiorne.

The following

Report of the Board of Directors,

which was read by the Secretary, was, on motion, received and adopted:

To the Members of the Western Gas Association: The annual meeting of the Board of Directors, which was held at 10 A.M., Tuesday, May 14, 1901, was called to order by the President, Mr. I. C. Copley, of Aurora, Ills. The following members of the Board were present: I. C. Copley, Aurora, Ills.; Thos. D. Miller, Dallas, Tex.; A. H. Barret, Louisville, Ky.; Z. T. F. Runner, Freeport, Ills.; Geo. McLean, Dubuque, Ia.; Jno. Gimper, Galveston, Tex.; John R. Lynn, Portsmouth, O.; Donald McDonald, Louisville, Ky.; H. C. Slater, Milwaukee, Wis.; and Jas. W. Dunbar, New Albany, Ind.

On motion of Mr. Donald McDonald, the following papers were accepted for presentation to the Association:

"Recuperative Furnaces of To-day: Directions for Operating and Testing," by Mr. Wm. E. Steinwedell, Belleville, Ills.

"A Stormy Experience," by Mr. John Gimper, Galveston, Tex.

"Gas and Hygiene," by Mr. James Ferrier, Columbus, Ga.

"Gas Association Libraries," by Mr. F. H. Shelton, Phila., Pa.

"Taxation of Gas Companies," by Mr. Geo. McLean, Dubuque, Ia.

"Isolated Generators for Bench Firing," by Mr. H. L. Doherty, Denver, Col.

"Prepayment Meter Accounts and Records," by Mr. Ernest Wm. Bell, St. Louis, Mo.

"Six Months' Experience in the Operation of Inclined Retorts," by Mr. A. H. Barret, Louisville, Ky.

"Wrinkle Department," edited by Mr. F. H. Shelton, Phila., Pa.

On account of the small attendance probable at the hour set for the election of officers, it was carried, on motion of Mr. D. McDonald, that the Board recommend the postponement of same, from 8 P.M. Wednesday, until Thursday forenoon.

All present members of the Association having been supplied with the last volume of proceedings now published, on motion of Mr. Barret it was carried that any member who may hereafter wish copies of same be charged at the rate of $2 per volume, and non-members $5 per volume. All members, however, are to be supplied, free of cost, copies of any additional volumes of proceedings that may hereafter be published.

On motion of Mr. John R. Lynn, the action of the Secretary in ordering a floral design, for funeral ceremonies over the late George Treadway Thompson, was approved.

The President appointed the following Committees:

On Membership.—Messrs. Wm. McDonald, Z. T. F. Runner and John Gimper.

On Introduction of Visitors.—Messrs. Thos. D. Miller, A. H. Barret and Donald McDonald.

Auditing Committee.—Messrs. Geo. McLean, John R. Lynn and H C. Slater.

The Secretary and Treasurer submitted his report for the year, which was referred to the Auditing Committee.

There being no further business the Board adjourned.

Jas. W. Dunbar, Sec.

Report of the Treasurer.

As Treasurer, Mr. Dunbar reported a total receipt for the year (May 1, 1901) of $1,881.50, an expenditure of $2,223.75, and a cash balance of $572.22.

Report of the Secretary.

As Secretary, Mr. Dunbar reported as follows:

Membership, May 1st, 1900		320
Admitted, 23d annual meeting		47
		367
Resignations	5	
Deceased	7	
Dropped, non-payment of dues	11	23
Membership, May 1st, 1901		344
Badges on hand, May 1st, 1900	15	
Sold during 23d annual meeting	7	
Badges on hand, May 1st, 1901		8

The President introduced Mr. W. E. Steinwedell, of Belleville, Ills., who read the following paper, entitled

RECUPERATIVE FURNACES OF TO-DAY: DIRECTIONS FOR OPERATING AND TESTING.

Recuperative furnaces for bench firing are steadily coming into more extensive use, being adopted both in new installations and reconstructions, except in very small works or exceptional localities where the low cost of fuel does not warrant the extra outlay for recuperation.

It has been demonstrated that they save about 50 per cent. in fuel, 6 per cent. in wear and tear of retorts, 30 per cent. in floor space per 1,000 cubic feet of gas made, and 25 per cent. in labor. The disadvantage in first cost, figuring per 1,000 cubic feet of gas made, is about 20 per cent.

The principles of this mode of heating retorts will not be entered into but a few words on the construction and general arrangement of recuperative furnaces are necessary. They consist of three parts:

1. The generator, containing hot coke or coal, from which carbon monoxide and hydrogen are obtained.

2. The recuperator, containing a system of adjacent flues by which the waste gases serve to heat the primary air before it is mixed with steam, and the secondary air before it enters the combustion chamber.

3. The combustion chamber, where the carbon monoxide and hydrogen are burned by the heated secondary air to carbon dioxide and water.

By recuperative furnaces will be understood the full-depth or most efficient type of this class of furnace made. The so-called half-depth furnaces are recuperative furnaces in every sense, only the recuperation is not carried out to the same extent as in the full-depth, and their efficiency is not as high.

The recuperator and combustion chamber are generally placed in the bench setting, but the position of the generator may be either of the following:

1. Generator in the arch. This type of bench is generally charged in front above the operating floor and is clinkered beneath, either in front or in the rear of the bench.

2. Generator outside the arch. In this style of construction the charging door is level with the operating floor, and the hot coke drawn from the retorts can be raked into the furnace with facility. Leaks in the brickwork of the generator are also easily located and repaired.

3. Generator outside the arch, and serving two or more benches. This type of setting is sometimes built without recuperators, the parties having them claiming that no decided advantage was obtained by heating the secondary air.

Either coal or coke can be used for firing the furnace, depending on the selling price of the latter and the cost of the former, 1,360 pounds of Illinois nut coal being about equal to 1,000 pounds of Pittsburg coke. For firing with coal a recuperative furnace should have a large generator, and recuperator flues of ample cross-section for the waste gases. The primary air should be well mixed with steam, the amount of secondary air increased, and coke used for fuel until the bench is up to heat. Sometimes it is necessary to change from coal to coke fire about once every week for a few hours to clean the flues of soot.

Before Starting.—Have the benches clean and airtight throughout and all metal parts in good working order. To keep a bench airtight a combination of fireclay and water, mixed to the consistency of thin paint and applied with a brush to the exterior surface of the brickwork of the stack once every two or three weeks, will prove effective.

New benches should first be slowly and thoroughly dried, by closing all openings except the main dampers and clinkering door, and starting a wood fire on the grate bars. After a few days of this clean coke may be added.

Starting.—Care should be taken to avoid an explosion of car

monoxide, which can be prevented if the following rules are observed: The bed of coke in the generator must be kept white hot, and to allow for an excess of air this bed should not extend more than 12 inches above the grate bars. The charging door is to be held partly open, or a perforated iron plate used to cover its opening. This will admit air and allow the operator to observe whether the coke in the generator is kept white hot.

When the walls of the combustion chamber become red, charge the generator with as much hot, clean coke as it will hold, seal up the opening with damp breeze and close the charging and clinkering doors.

The primary and secondary air slides should now be opened and the water and steam supplies turned on. This forms carbon monoxide in the generator, which burns upon coming in contact with the glowing walls of the combustion chamber. As a precaution a hot iron bar is sometimes placed before the openings for the carbon monoxide into the combustion chamber. Reduce the secondary air supply until a blue flame appears where the waste gases enter the chimney, or slowly increase the secondary air, waiting several minutes after each change, until only short blue flames are visible at this point. A slight excess of secondary air is better than a slight deficiency. As the heat increases gradually close the main dampers until the right temperature is maintained with the primary and secondary air slides, each partly open and properly set according to the tests described later. Open the main dampers as little as possible to give the required vacuum.

Operating.—Fire regularly, full, and towards the back, with hot coke direct from the retorts, and keep the charging door open as short a time as possible. If charging with cold coke fire often enough to prevent the top layer in the generator from becoming red hot.

Clinker at regular intervals, depending on the class of fuel, from 24 to 48 hours, using supplementary grate bars, about 5 feet long by 3 inches by 3½ inches, with a hole in one end for withdrawing them after the operation is completed. By allowing steam to enter with the primary air, the clinkers are kept softer, are not so injurious to the furnace walls, and a valuable heating gas is produced in the generator thereby. The steam under the grate bars should be regulated at about 30 pounds of water per 100 pounds of coke consumed. The furnace door should never be opened during clinkering.

To raise the heat, inspect the air and gas nostril holes, and if in order prick the fuel on the grate bars to allow the free passage of primary air. Open the dampers slightly and if, after one or two charges, there should be no material change, the primary, secondary and main dampers should be opened ¼ of an inch at a time and the results carefully noted. When the temperature of the bench is too low a considerable amount of liquid tar will be found in the mouthpiece.

To lower the heat, slightly close the dampers, or in connection with this the primary air slides, and regulate the secondary slides to give the proper combustion.

The heat in the recuperators should not be more than a dull red below the secondary air inlets, as this will probably mean too little secondary air.

The draught (*a*) under the grate bars, (*b*) above the coke, (*c*) at the entrance of gases into the recuperator, and (*d*) at the outlet of the recuperator, should be measured and noted on paper once in every watch.

The CO canals, combustion chamber, and entrance to the chimneys are to be inspected several times on each watch. The CO canals should never be white hot, and only short blue flames should enter the chimneys. If the blue flames are long, secondary air is wanting. If no blue flames are noticeable, more or less secondary air is in excess.

If bright yellow flames are present, it is the sign of a leaky retort. All these observations must be made when not clinkering.

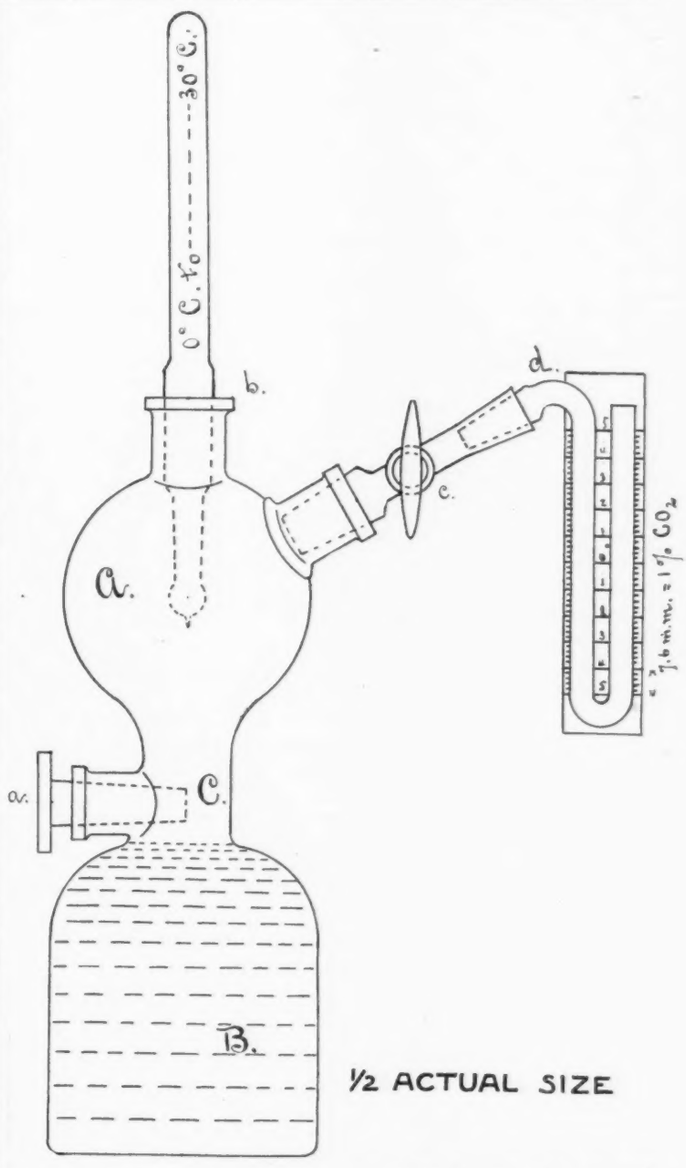
Test the benches daily for leaks with a lighted torch. All pressure gauges are to be kept in first-class condition.

A vacuum of 6-10 is sufficient at the outlet of the last waste gas flue, and is obtained with from 400° to 500° F.

A supply of sand and a shovel should be kept on the stack for use in case of accident. Fresh mud should also be kept on hand in the retort house. Forty-two inches of coke in the generator is sufficient, although 50 inches is better. The air regulators and dampers which should not be constantly altered are to be placed so that the interior of the bench seems slightly veiled in fog. Flames in the bench show too little air, and a perfectly clear interior too much air.

Carbonic acid gas determinations should be made once a week, and are most easily obtained with a special apparatus designed for this purpose by Mr. William von Oechelhaeuser, of Dessau, Germany.

A sketch of this is shown in the annexed diagram, the operation being as follows: The vessel *B* is charged with a solution consisting of



¼ ounce or 16 gr. of caustic potash or caustic soda dissolved in enough distilled water to fill it to the middle of *C*. The gas is then forced or drawn through the upper bulb *A* from *c* to *a* until a good sample is secured. Both these openings are then closed, the whole apparatus inverted a few times, placed on a table, and the siphon gauge attached from which the percentage of carbon dioxide can be directly read. If the temperature before and after the absorption differs, ½ per cent. must be added or subtracted for every degree of increase or decrease of temperature respectively.

The carbonic acid gas in the generator gases should not exceed 3 per cent.; in the chimney it should reach a maximum of 19 per cent. (at least 17 per cent.), which will show that there is no uncombined or superfluous oxygen in the waste gases.

If less than 19 per cent. carbonic acid is found, two causes are possible; there is either unburnt CO in the waste gases, which will only heat the chimney, or a surplus of oxygen (air) is in combination. Both these defects cannot occur at once, and to determine which is present a test for CO must be made. If CO is not present then oxygen is in excess in as many per cent. as the CO_2 was less than 19 per cent. The excess equals five times the excess of oxygen.

Shutting Down.—After the charges, which should be left in the retorts, are burnt, close the stock valve, seal up the primary and secondary air slides and other openings with clay, and when the bench is cool and dark open the ascension pipe caps fully.

Dip-pipes that have a cap in common with the ascension pipes should be closed with wooden stoppers to prevent dust from falling into the hydraulic main. Draw the charges and loose retort carbon, clean the furnace, oil the iron work where necessary, pull out the stoppers, and lay the retort lids on loosely.

It will be seen from the foregoing, that the value of a recuperative furnace depends on,

1. Practical mechanical construction.
2. Even and equal distribution of heat.
3. Amount of fuel necessary for firing, per 100 pounds of coal carbonized.
4. Small loss of draught from a point under the grate bars to the outlet of recuperator.
5. Minimum amount of CO_2 in generator gases.
6. Maximum amount of CO_2 in chimney gases.

Discussion.

The President called upon Mr. Frederic Egner to open the discussion.

Mr. F. Egner—Mr. Steinwedell is to be complimented on his choice of a subject. He has not followed in the wake of the recently somewhat popular fad of writing for a technical Association a paper on the commercial aspect of the gas business, and making an easy "try" for cheap applause by an account of bizarre methods to increase gas sales. He has gone to the beginning of the matter—the retort house—wherein, as one of the fathers of gas lighting, Samuel Clegg, said, "The money is made." But while Mr. Steinwedell has treated his subject in a reasonably thorough and instructive manner, we may be excused if we ask for general information, a question or two; and thus perhaps bring out a few additional facts suggested by his admirable paper. It would be interesting, no doubt, if Mr. Steinwedell would explain why, if the recuperative furnaces save 50 per cent. in fuel, 40 per cent. in wear and tear of the retorts, 30 per cent. in floor space per 1,000 cubic feet of gas made, and 25 per cent. in labor, they would not do for *any* gas works which may be classed as such, regardless of cost of fuel or additional outlay in cost of construction. It seems to me that Mr. Steinwedell has been quite conservative in his statements as to the savings which can be effected by employing the recuperative furnace. In some respects his figures are much too low. For instance, the actual physical labor saved the fireman if not the Company, in all cases, is fully twice 25 per cent. And if we save 40 per cent. in wear and tear of the bench by using that style of a furnace, a low cost of fuel should not deter anyone from having a recuperative bench, not to mention the other advantages very properly enumerated by Mr. Steinwedell. Perhaps when writing his paper he had in mind conditions such as we find sometimes, where, from the nature of the ground, we cannot go *down* to construct a pit, or where the cost of going up, maybe raising the whole retort house in order that a stage floor could be introduced, would be prohibitive. While Mr. Steinwedell has given the exact relative conditions which govern the saving to be expected by the employment of recuperative furnaces, either full or half depth, he has not stated, probably supposing it to be generally understood, that management, intelligent or otherwise, will affect the results obtained from either, so that sometimes we find that one man gets better results from a half-depth furnace than another does from a well designed, well constructed full depth furnace, although Mr. Steinwedell clearly shows that the full depth furnace ought to give the best results. Mr. Steinwedell has clearly, and correctly, though concisely, enunciated the principles which govern the proper management of the recuperative furnace, and which if closely followed must result in successful operations. He, therefore, deserves the thanks of all those who have not yet had any experience with that kind of a furnace, and also the same from some who have, and who may have found snags in the way of smooth sailing with them. Mr. Steinwedell says that "The steam under the grate bars should be regulated at about 30 pounds of water to the 100 pounds of coke consumed." And it would be interesting to know how he advises to accomplish that. Does he favor a reliance altogether upon the water evaporated under the grate bars in the ash pan of the furnace, or would he favor admitting steam obtained from other sources by means of a convenient pipe suitably arranged? I think I would favor the latter course as the more reliable. Mr. Steinwedell's direction to frequently inspect the various parts of the bench during each watch, and in other parts daily, is a very good one to follow, if you can get men to do it; and his remarks upon the best depth of fuel to be maintained in a recuperative furnace are worthy of special notice. Many times have I seen furnaces at one end of which the depth of fuel would be 60 to 72 inches, while at the opposite end of the same furnace the depth would not be 30 inches at any time, and nothing at all sometimes, with results in accordance, viz: Irregular heats in the bench, cracked and sagging retorts, stopped ascension pipes, large coke consumption, heavy, hard clinker in the furnace; overworked (through their own laziness and ignorance) stokers, and irregular yield, both as to quality and quantity of gas produced. This single feature of proper depth of fuel in the furnace which Mr. Steinwedell mentions is alone one, if acted upon, which makes this paper especially worthy to have been brought before us. It is this even depth of fuel, more easily kept in some constructions than in others, which has been instrumental in recommending the so-called "Munich furnace" to many of the successful and able gas engineers in the East, though why it should be called the "Munich furnace" and not just as well the "St. Louis furnace" it will not be so easy to explain, for we used that kind of a furnace at the old Laclede gas works some years before the same became known over here as the "Munich furnace." Mr. William Farmer, who built those works, was the designer of that furnace, which was very successful indeed. It consumed less than 11 pounds of coke per 100 pounds of coal carbonized. It would not be germane to the subject under discussion to tell why these furnaces were not continued there, but it was at least co-equal with, and certainly prior to, the advent of the "Munich furnace" in America. The value of Mr. Steinwedell's paper, though considerable, would be still greater, perhaps, if he had given his views on the proper proportion, or best proportions of the various parts of the furnace to the beuch in general. Some well informed gas engineers hold differing views upon these points, especially as to the most suitable area of grate, and if additional facts upon that part of the matter could be brought out at this meeting, I am sure these proceedings would become of great value to us all. In conclusion, Mr. President, permit me again to compliment Mr. Steinwedell on his good judgment in the selection of his subject, and the able manner in which he has acquitted himself of his task.

Mr. Norris—There is an apparent typographical error on page 50, where it is stated that the clinker bars are 5 feet long by 3 inches by 3½ inches. I presume it means ¾ of an inch.

Mr. Steinwedell—Yes, sir.

Mr. Norris—Mr. Steinwedell speaks of testing the bench daily for leaks by a lighted torch. This is a detail with which I am not entirely familiar. And further along, there is an apparatus described for testing for carbonic acid. As I understand the apparatus the pressure to which the gas is subjected after the absorption of carbonic acid is slightly less than before that absorption. This, I presume, introduces a slight error, though perhaps in some cases not a serious one. If, however, the absorption of carbonic acid is about 19 per cent., then the pressure to which the gas is subjected must be about ⅘ of what it was before, and if I grasp the action of the apparatus the consequent error would be very considerable. Moreover, the gas is collected in contact with the absorbent reagent, and its readings must be unreliable.

Mr. MacBeth—Has Mr. Steinwedell had any trouble from the overheating of the middle bench of 9's?

Mr. Somerville—It struck me, being one of the old fashioned company managers, while listening to the reading of the paper, that to make this furnace successful we would have to have men far higher in intelligence than the present stokers. I have never run one of these furnaces, but, from what Mr. Steinwedell said, it seems there is frequently a failure to get the best results from want of knowledge. I should judge from his description that to make these furnaces successful depends greatly on the men you have in the retort house, or that the furnaces require superior intelligence and further direction, along with careful watching of your apparatus. With a stoker looking at the gauges for CO_2 and CO, and things like that, it would be impossible to run them. In fact, we would require college men to watch the stoking. I would like to ask Mr. Steinwedell if he has that class of people in his place, or if it requires that type of workmen.

Mr. A. E. Forstall—I think Mr. Somerville has made rather a mountain out of a molehill. I have run regenerative or recuperative benches for a good many years without much assistance ou'side of the ordinary retort house foreman. I think the first requisite in starting to operate the bench is to teach your foreman what you are supposed to be doing. That is, you want to give him a certain amount of knowledge as to gaseous firing. He wants to know that in the generator of that bench you are making carbonic oxide, a gas which is to burn again in the combustion chamber, to produce the heat in the bench. And you also want to tell him how to fire the benches, that you don't want your furnace hot to make your bench hot, otherwise he will get all your heat in the furnace and no heat in the bench. At the same time I don't think the regenerative benches can be run satisfactorily without a certain amount of supervision from the superintendent of the works. That supervision will only take a very few minutes every day, as by keeping a record of the damper openings, the primary and secondary openings, and of all the changes made, the

superintendent can tell exactly the condition of things in the retort house by a very slight amount of supervision. I have also found it well to put in a pretty good man, that is a selected fireman, to take care of the furnaces and have charge of them entirely. I would pick out as good a fireman as I could and pay him regular fireman's wages, and let him have entire charge of the furnaces. As I have said before two or three times, we were not supplied with a chemist at our gas works, so we ran the benches by a set of rough and ready rules, descriptions of which can be found both in the proceedings of this Association and of the American Gas Light Association. It is hardly worth while for me to say that you do not need a college man to fire or run your benches. If you have a good superintendent who will give 10 minutes a day to that branch of the work, the benches can be kept in perfect running condition, the heats being kept up and the fuel account down, with the aid of the ordinary retort house foreman.

Mr. Barret—Following the same line on which Mr. Forstall has just spoken, we have the additional fact, taking Mr. Somerville's statement of what the requirements are, that, as we improve in our product from necessity, it does require more skilled labor. Take the same thing in other lines. The old slide valve engine can be run by almost anybody, but the complicated engines of to day take a better class of superintendence. I don't think the criticisms so far of Mr. Steinwedell's paper are legitimate. The paper seems to me a very plain description of how to run a regenerative bench. I think the issues so far taken are side ones entirely.

Mr. Chollar—So far as I am concerned, I will have to admit that my experience in the operation of regenerator fired benches is slight, but Mr. Steinwedell has told us in a very few words how such benches can be operated successfully without regard to their construction. His paper is applicable to all kinds of regenerators. Now, what is the difference between regenerator and recuperator benches, as mentioned in the technical works and in the Associations, is a question I would like to know something about. If somebody can give a clear, distinct definition, that would draw the line sharp in respect of showing the difference between the one and the other, I would like to hear it.

The President—It is part of the business for which this Association is organized to determine that and other questions.

Mr. Ferrier—I want to call attention to the statement in the paper that "the excess equals 5 times the excess of oxygen." I suppose it was meant that excess of air is 5 times the excess of oxygen.

Mr. Steinwedell—Regarding Mr. Egner's question as to the saving, I think the reason why recuperative benches are not used in a great many places is, as he said, that you cannot go down very deep with economy, on account of water or poor soil for foundations, and probably on account of the fact you can get gas coal so much cheaper in some localities than you can in others. For instance, some companies get gas coal for $2 a ton delivered, while others get it for $5 a ton delivered. That would be quite an item, whether you are firing with coke or coal, and whether it is worth while to invest the extra amount of money in a recuperator in consideration of the saving effected. Regarding whether it is best to admit live steam under the grate bars, or to use water in the ashpit, it might be said there are many different methods of doing so. In some cases water is run into the recuperator through a system of return pipes connected and acting as a feedwater heater, so that the water is heated before it reaches the ashpit. In such case you will be saving that amount of heat and find cold water would lower the temperature of the waste gases. In regard to grate area and cross section of flues, etc., I think that would come under the head of the designing of recuperative furnaces, and it would be a very good idea for this Association to have a paper on that subject. I don't remember ever having seen one on that subject. Mr. Norris's question, concerning the apparatus for testing carbon dioxide, was as to within what degree of accuracy that would be. Several slight inaccuracies come in there, but I could not explain them very well without the use of a blackboard. The theory is, assuming 760 mm. to be the normal height of the barometer, as CO_2 is absorbed in the upper bulb a diminution of the pressure occurs. Supposing that 1 per cent. CO_2 is absorbed, the loss in pressure would be 7.6 mm. of mercury. Respecting the lighted torch, that is only used in looking over the bench. You take a lighted torch and pass it around outside of the bench. If there is a leak—sometimes it cannot be seen—the flame will be drawn inward. It is in order to detect by the draught a leak in the bench. The probable reason that the middle retort gets warmer towards the end of any particular watch is that it is midway of the upper and lower retort, and so, naturally, as it is nearer the center of combustion, it would have a little higher temperature than the outside retorts. Concerning the intelligence of a retort house hand, although it is better he should know what he is doing, it is only necessary to the results that he should know, in the matter of apparatus for testing for carbon dioxide, how to read the scale. It is not necessary for him to know why, although he will pick that up naturally from time to time. I have been asked why sand should be kept on top of the bench. In one case a severe crack occurred on the top of the retort house stack, and it was the custom in that works to keep a supply of sand and a shovel on top of the bench; by shoveling in sand the crack was stopped and any further mischief prevented. The difference between a regenerative and a recuperative bench, as I look at it, is about this. There is no such thing as regeneration in a bench. You only use the waste heat as it goes into the chimney to recuperate. I don't think I have used the term regenerator in my paper in any place, and the reason that I say recuperator is that you save the heat of the waste gases as they go to the chimney. No regeneration takes place in any sense. I think that is as near as I can answer Mr. Chollar's question.

Mr. Chollar—Explaining the difference between regeneration and recuperation, we may possibly need regeneration, but we won't get it. If we get good recuperation we will be well satisfied.

Mr. A. E. Forstall—I think that as the word regenerative is commonly used, it is synonymous with recuperative. That is, when we speak of a regenerative bench, we are using, as Mr. Steinwedell says, an incorrect term, but we are using it in the meaning of recuperative. At least that has always been my understanding of a regenerative bench. There is, however, a distinction between a recuperative bench and a generator bench. The recuperative bench is the generator bench to which the recuperators are added. The generator bench is merely a bench in which the heating is done by an indirect process in which the fuel is burned by an indirect process. In the ordinary direct way with the free firing bench, the combustion of the fuel is completed in one operation. It is burned at once to carbonic acid. In the regenerative bench the fuel is taken through another step. The fuel is burned in the furnace to carbonic oxide, then the carbonic oxide is burned in the combustion chamber to carbonic acid. Some question whether there is any advantage in recuperation at all. They claim that all you need is to have generative firing without recuperation, that you will get just as good results, or results that are so nearly as good that the extra cost of recuperation is not warranted. I think probably Mr. Chollar had the distinction between a generator bench and a recuperator bench in mind when he spoke of the difference between regenerative bench and recuperative bench.

Mr. Chollar—My question had direct reference to a regenerative bench as compared with a recuperative bench or furnace, not a comparison between a generative bench and a recuperative bench.

Mr. Egner—When I first read Mr. Steinwedell's paper I was impressed with the thought that it was as good and as practical a paper as we had ever had before this Association, and I think when the gentlemen return home and read it over carefully they will agree with me. I think its influence will go beyond this room, and that it does not really require such an education as we generally suppose a college man to have. It is a very practical thing in simple language, and I was impressed by its value from my travels to and fro through this country, in seeing so many who did not seem to understand just exactly what was best for them to do. When I saw this paper the thought came to me, Mr. Steinwedell has just hit the nail right square on the head. I think his paper is as good as any we have ever had before this Association.

Mr. J. R. Lynn—Mr. Steinwedell replied to a question put to him in reference to the different heats in the middle retort of a bench of 6's, and the central one in the bench of 9's. I don't think under any consideration, in a bench of 6's or 9's, you could get any other result than that the middle or center retorts would be hotter than the others.

Mr. MacBeth—I meant 6's instead of 9's. The bottom retort in a bench of 9's runs a good deal hotter than the others. I would like to ask Mr. Steinwedell in regard to that.

Mr. Steinwedell—The lower retort in a bench of 9's as to the middle. About the only way to do would be to have the retort a little larger, and charge it with a greater weight of coal. That would keep down the heat to a certain extent; but, being directly over the combustion chamber, it would naturally be a little higher. I would advise picking out the best retort in the batch for that place of setting.

On motion of Mr. Somerville, a vote of thanks was tendered Mr. Steinwedell for his excellent paper.

[To be Continued.]

Aluminum-Zinc Alloys.

By Dr. Joseph W. Richards.

Many contradictory statements have appeared regarding the properties of aluminum zinc alloys ; and since these statements were all apparently made in good faith, the divergent accounts are probably to be ascribed to the use of impure aluminum or impure zinc, or to a lack of the knowledge of how to properly alloy the pure metals. In fact, the experience gained in the practice of alloying enables one to continually obtain better and better results, such as are wholly unattainable to the unskilled metallurgist.

Tissier Brothers, in the first book written about aluminum, describe the alloys of 1 part of aluminum with 2, 3 and 10 parts of zinc. They found these to be brittle, looking like zinc, fine grained and more fusible than aluminum, but less so than zinc. These alloys were used at first in attempts to solder aluminum, but they would not run liquid, and made poor looking joints. Aside from this, the alloys had no mechanically useful properties. My own experience confirms these statements. Out of 8 alloys, which I have made, containing 2, 3, 4, 5, 6, 7, 8 and 9 parts of zinc to 1 part of aluminum, with specific gravity from 4½ to 6, there appears to be none with any specially valuable mechanical properties. Even the alloy of 1 part aluminum to 1 part of zinc, with a specific gravity of 4, may be classed with the above alloys. Alloys containing more aluminum than zinc first commence to possess valuable properties.

The alloy of 2 aluminum to 1 of zinc, containing 33⅓ per cent. of zinc, is a remarkable alloy. W. F. Durand has described it (*Science*, 1897, p. 396) as being "equal to cast iron in strength, melts about 800° F. (425° C.), does not readily oxidize, takes a fine finish, perfectly fills the joints of the mold, and is, like cast iron, brittle, but resists corrosion well." After several years' experience with this alloy, commencing in 1895, I can substantiate the general correctness of Durand's statements, and add to them the following observations :

Experience in making this alloy has led to considerable improvement in the results obtained. The first samples made were just about equal to cast iron in strength, tests showing 18,000 to 24,000 pounds breaking strain per square inch, with no perceptible elongation ; but at present there is no difficulty in reaching a tensile strength of 40,000 pounds, in castings. It resembles closely in its characteristics a high carbon steel, being extremely rigid, slightly elastic and breaking short with a fine grained fracture. It works well under the tools, in turning or boring, not requiring lubrication. It is the hardest and strongest of the valuable alloys of aluminum and zinc, takes a high polish and keeps its color very well. It is not so resistant to shock as the other alloys containing less zinc. Its specific gravity is 3.8, and calculation shows the remarkable contraction of 17 per cent. taking place during the alloying of its ingredients, which suggests the cause of its great strength. Numerous uses for this strong, rigid alloy will suggest themselves to every mechanical engineer.

The alloy of 3 parts aluminum to 1 part zinc, containing 25 per cent. of zinc, is the most generally useful of all the aluminum-zinc alloys. It is softer than the previous alloy, has a tensile strength of 35,000 pounds per square inch, and elastic limit nearly the same, with a slight elongation before breaking. It is, therefore, not a malleable alloy, but yet it is not brittle, for it bends slighly before breaking. This quality is a valuable one, for it enables one to straighten out a casting to a certain extent under the hammer. Remarkably clean and sharp castings can be made with it, when experience has been attained with the proper gating of the mold and the exact temperature of casting. As with all these alloys, overheating in the crucible must be scrupulously avoided, as well as the use of iron stirring implements, since oxide or dross does not separate out of the metals easily, and may thus get poured into the mold and injure the casting. Its specific gravity is 3.4, and the contraction taking place during alloying is, therefore, 14 per cent., which indicates a close and intimate combination. This alloy, when properly made from the pure metals, is all that could be desired in its working qualities, being equal to the finest brass in the lathe, under the drill, and in not clogging the file. It casts sound, takes a high polish, and has as fine a color as the best aluminum. It is not so hard and short as the 33 per cent. zinc alloy, nor quite so strong, but has supplanted it for most purposes because of its better working qualities and greater reliability under shock. It is at present in use for scale beams, surveying and astronomical instruments, light machine parts, gear wheels cut from blanks, cash registers, calculating machines, testing machines, indicator drums, surgical appliances, cases and parts of pneumatic tools, etc. It is non-magnetic, and therefore particularly useful in scientific instruments. The use of this alloy is increasing rapidly, and it bids fair to be the most generally useful of the light aluminum zinc alloys.

Below 25 per cent. of zinc the strength and hardness of the alloys decrease rapidly, and when the zinc is 15 per cent. or less the alloy can be forged, rolled or drawn. The alloy with 15 per cent. of zinc has in castings an elastic limit 16,000 pounds per square inch, tensile strength 22,330 pounds, elongation in 2 inches 6 per cent., and reduction of area 10½ per cent. It can be rolled and drawn into wire if frequently annealed. Mechanical tests of this alloy after working have not yet been made.

The alloys with less than 15 per cent. of zinc become softer and weaker, roll and draw well, but require lubrication of the tools during working. They may find application for special purposes where the previously mentioned alloys are too hard.

The Design of Steam Power Plants.—No. IX.—Mechanical Draft and Chimney.[1]

[By Mr. Henry C. Meyer, Jr., in *Engineering Record.*]

Theory of Combustion.—As pointed out in a previous chapter, there are two independent factors that effect the efficiency of a steam boiler. One is the efficiency of the heating surface or its ability to transmit to the water the heat to which it is exposed, and the other is the efficiency of the furnace, by which is meant the amount of heat actually contained in each unit volume of furnace gas compared to that theoretically possible of attainment. A high surface efficiency demands that the temperature of the gases in contact with the boiler be as high as possible, for the rate of heat transfer is some function of the difference in temperature of the water and gases, and the greater the difference the more heat per unit of surface will be transmitted. A high furnace efficiency demands that just the proper amount of air be supplied to the furnace per pound of fuel burned. Too little air, due to a too thick bed of fuel on the grate in proportion to the available draft, results in loss due to the incomplete combustion of the fuel, part of the carbon being burned only to carbonic oxide instead of to carbonic acid, as it should if the combustion is complete. Too much air, on the other hand, due to a too thin bed of fuel, lowers the temperature of the furnace gases and thereby decreases the heat transferred per unit of heating surface, owing to the smaller difference between the gas and the water temperatures ; it also increases the volume of gases and this in turn necessarily increases the velocity of their flow through the passages of the boiler, thus giving less time for their heat to be absorbed.

A thin fire allows an excess of air to enter the furnace, while a thick fire tends to reduce it on account of the greater resistance offered. Mr. Walter B. Snow writes as follows in explaining the higher efficiency of a high rate of combustion : "If the size of a grate is reduced but the same amount of fuel burned by increasing the rate of combustion, the diminished area of the grate and of the exposed interstices between the fuel necessitates a higher velocity to secure the admission of a given volume of air. This increased velocity in turn requires greater draft or air pressure. The volume at any given temperature passing through the coal is proportional to the velocity, but the pressure varies as the square of the velocity. Therefore, if a given grate be reduced one-half and the rate of combustion doubled, so as to maintain the same total consumption, the same volume of air would have to travel through the exposed interstices at twice the velocity. But the pressure or vacuum would be four times as great, and, as a consequence, the air would be forced or drawn into spaces between the fuel which it could not reach under lesser impelling force. Much more intimate contact and distribution are the results. Less free oxygen passes through the fuel bed unconsumed, and for a given supply of air a higher efficiency of the fuel is attained." Most leading authorities unite in the belief that a higher efficiency is secured in steam boilers when operating at comparatively high rates of combustion. It is advisable to provide for this in plants using coal that can be burned rapidly, care being taken at the same time to provide sufficient draft to run the boilers over their normal rating when occasion demands. Certain coals high in ash and in sulphur cannot be burned at more than ordinary rates for reasons explained in Chapter II. in the section relating to coals. There are other reasons for burning coal at a high rate of combustion than those explained in the previous paragraph.

Necessity for Ample Draft.—Means for providing a small draft for steam boilers is one of the most essential features of a plant, for if sufficient coal can be burned under a boiler it will generate steam several times as rapidly as is the custom under normal conditions. This means that a smaller number of the boilers can be relied upon to fur-

1. *Ante*, p. 729.

nish the steam needed, while others are shut down for repairs or cleaning than would be needed if less draft was available. The investment for boilers, therefore, need not be so great. Of course, when making steam at abnormally high rates of evaporation, the efficiency is not so good as under the conditions of normal working, but it is cheaper to allow some fuel to go to waste occasionally than to spend more money in the first place for boilers only used at long intervals. More complaints with steam boilers are probably traceable to insufficient draft than to any other cause. Draft is secured by a chimney, by mechanical draft produced by fans, or by a steam jet blower.

Mechanical Draft.—Mechanical draft may be secured by two methods, known as induced draft and forced draft. In the former, a fan is connected with the smoke flue from a boiler or batteries of boilers, so as to suck the gases through the furnace, gas passages and flues to the fan, which discharges it usually to a short chimney, but sometimes to a high one. Forced draft is the term applied to that system where air is forced into the furnace beneath the grate bars, either by a fan or by a steam jet blower. If mechanical draft is to be used, induced draft is usually installed in new plants. Forced draft with a fan is sometimes provided for in new plants, but more often in old plants, as it is sometimes easier to install than the induced system. The objection to forced draft lies in the fact that a pressure greater than that of the atmosphere is created in the furnace and gas passages which may cause the gas to pass outward through cracks in the setting of boilers and through the fire doors when the fires are being replenished or cleaned. Dampers in the blast pipe and uptake, to be closed when the fire doors are opened, may overcome this latter objection. With induced draft the leakage through the doors and brickwork is, of course, inward.

Steam jet blowers can only produce a moderate draft. Their steam is believed to be useful in preventing clinker from forming on the grates with certain kinds of anthracite coals. Steam jets are used to a considerable, but decreasing, extent in the anthracite coal regions. Experiments made by the Board of Steam Engineers of the Navy Department with five different types of steam jets showed that they used from 8.3 to 21.2 per cent. of the steam generated in the boiler to which the jets were applied. Draft can be obtained from fans with only a fractional part of these amounts. Under ordinary conditions a fan for mechanical draft can be driven by from 1 to 5 per cent. of the steam evaporated in the boilers operating under ordinary conditions, depending upon the size of the plant.

Advantages of Mechanical Draft.—Draft produced by fans possesses many advantanges over chimneys as ordinarily proportioned. Probably the greatest of these is its flexibility, it being possible to regulate the speed of the fan so that the proper rate of combustion for the amount of steam required is maintained entirely independent of the weather conditions; another important advantage is the ability of the fans to create a much greater draft than is possible with a chimney. Steam engines for driving fans are frequently fitted with valves arranged to govern the speed of the engine according as the boiler pressure varies, increasing it as the pressure falls and reducing it as it rises above the normal. Mechanical draft enables economizers to be placed in the flue and reduce the temperature of the escaping gases by heating the feed water far below the temperature that is necessary in a chimney to create a draft. The reduction in draft due to the use of economizers is a much greater percentage of the available draft with a chimney than it is of the draft where fans are employed. Again, the greater draft of fans enables cheap low-grade fuels to be burned that could not easily be used with the chimney draft, and the saving that these fuels brings about in some localities is a very considerable sum of money. Still another point in favor of mechanical draft lies in the portability of the fans in case a change of location is desired.

Theory of Fans.—Before explaining the method of selecting a fan for a given service it is necessary to consider briefly their theory of operation. Fans for mechanical draft are invariably of the centrifugal type and consist of a paddle wheel revolving in a sheet iron casing, the air entering an opening in the casing at the axis of the wheel and being propelled radially to the casing by the action of centrifugal force, the air escaping by an outlet provided. The velocity with which the air is moved is expressed by the well known formula:

$$v = \sqrt{2gh}. \qquad (1)$$

in which v equals the velocity and h equals the head due to the velocity and also to the pressure divided by the density. Therefore,

$$v = \sqrt{(2gP \div d)}. \qquad (2)$$

The work done in moving this air is equal to the product of the velocity of the air in feet per second, the pressure in pounds per square foot and the effective area in square feet over which this pressure is exerted. If W represents the work done, P the pressure in pounds per square foot, a the area in square feet and v the velocity in feet per second, then:

$$W = Pav. \qquad (3)$$

From (2) we have, by squaring and transposing:

$$P = av^2 \div 2g. \qquad (4)$$

and substituting its value in (3) we have:

$$W = dav^3 \div 2g. \qquad (5)$$

From this it will be seen that the power required to drive a fan varies as the cube of the velocity. In other words if the velocity is doubled the power required will be 8-fold; if tripled, 27 fold. As the velocity of the air is practically the same as the peripheral speed of the fan it will be seen how essential it is to use a large fan at its proper speed rather than a small fan running at a higher speed than is necessary to obtain the desired pressure, to obtain the desired volume. The pressure varies as the square on the speed, as shown in formula (4), hence the pressure is quadrupled by doubling the speed.

Design of Fans.—From the work upon "Mechanical Draft" by Mr. Walter B. Snow, published by the B. F. Sturtevant Company, the following quotations relating to the design of fans have been taken:

"In the design of a wheel to meet given requirements, it is necessary to make its peripheral speed such as to create the desired pressure, and then so proportion its width as to provide for the required air volume. Evidently the velocity and corresponding pressure may be obtained either with a small wheel running at high speed or a large wheel running at low speed. But if the diameter of the wheel be taken too small, it may be impossible to adopt a width, within reasonable limits, which will permit of the passage of the necessary amount of air under the desired pressure. Under this condition it will be necessary to run the fan at higher speed in order to obtain the desired volume. But this results in raising the pressure above that desired, and in unnecessarily increasing the power required. On the other hand, if the wheel be made of excessive diameter it will become almost impracticable on account of its narrowness. Between these two extremes a diameter must be intelligently adopted which will give the best proportions.

"It has been determined experimentally that a peripheral discharge fan, if inclosed in a case, has the ability, if driven to a certain speed, to maintain the pressure corresponding to its tip velocity over an effective area which is usually denominated the 'square inches of blast.' This area is the limit of its capacity to maintain the given pressure. If it be increased the pressure will be reduced, but if decreased the pressure will remain the same. As fan housings are usually constructed, this area is considerably less than that of either the regular inlet or outlet.

"The square inches of blast, or, as it may be termed, the capacity area of a cased fan, may be approximately expressed by the empirical formula:

$$\text{Capacity area} = DW \div X.$$

In which D = diameter of fan wheel in inches.
W = width of fan wheel at circumference in inches.
X = a constant dependent upon the type of fan and casing.

"An approximate value for X for Sturtevant fans for general practice is not far from 3, but this is to be used only to determine the capacity area over which the given pressure may be maintained. This is not a measure of the area of the casing outlet, which is always larger than the square inches of blast. As a consequence, the pressure is lower and the volume discharged is somewhat greater than would result through an outlet having the square inches of blast for its area. But the maximum pressure may be realized when the sum of resistances is equivalent to a reduction of effective outlet area to that of square inches of blast. The volume of air which, under the given pressure, will flow through the given capacity area, and hence the volumetric capacity of the fan under the given conditions, may be determined from Table I. In a similar manner the horse power may be ascertained, the proper efficiency coefficient being applied.

"Both the volume and the power required will evidently increase with the area of the outlet, being greater with the normal outlet than with that representing the capacity area. But this increase will not be proportional to the area, for the pressure and consequently the velocity will be lower with the larger area. The greatest delivery of air and the largest consumption of power will occur when the casing is entirely removed and the fan left free to discharge entirely around its periphery.

"If volume alone regardless of pressure is the requisite, the larger the fan the less the power required. There is a strong temptation, however, for a purchaser to buy a smaller fan and run it at a higher speed; for he sees only the first cost and does not realize the entailed expendi-

ture for extra power. If possible, a fan should never be made so small that it is necessary to run it above the required pressure in order to deliver the necessary volume. To double the volume under such circumstances requires 8 times the power; 3 times the volume demands 27 times the power.

"When a fan is employed for exhausting hot air or gases, the speed required to maintain a given pressure difference is evidently greater than that necessary when cold air is handled, the difference being due to, and inversely proportional to, the absolute temperature."

With forced draft it will be safe to assume that 300 cubic feet of air are supplied per pound of coal burned, and with induced draft 300 cubic feet supplied but 600 cubic feet exhausted by the fan if the gases are to be at a temperature of about 500° F. or 450 cubic feet exhausted if at 300° temperature, as might be expected with economizers. With induced draft the fan has to handle hot gases of approximately double the volume that it would if the fan was supplying air to the grates. As the gases are lighter, however, the power required per cubic foot of gas removed is less than it is per cubic foot of air with forced draft. Knowing the amount of coal burned under ordinary conditions, say 4 pounds per boiler horse power per hour, the amount of air required per minute can be determined. The pressures usually required in forced draft vary from ½ to 1 ounce per square inch and in induced draft from ½ to ¾ ounce, depending on the fineness of fuel, the readiness with which it burns, the length of flues and number of bends in them, etc.

Tables I. and II. are taken from "Mechanical Draft" before mentioned. In the former is given the volume of air in cubic feet for various pressures which may be discharged in 1 minute through an orifice having an effective area of discharge of 1 square inch, or per square inch of blast. The method of using these tables can best be explained, perhaps, by working out a typical case. Suppose we are to design an induced draft fan to handle the gases from 1,000 horse power of boilers against a pressure of ¾ ounce. At 4 pounds of coal per horse power per hour and 600 cubic feet of gas per pound, 40,000 cubic feet of gas would have to be exhausted per minute. Opposite ¾ ounce pressure in Table I. it will be seen that a fan will supply 31.06 cubic feet, say 31 cubic feet, per square inch of blast. Dividing 40,000 by 31 would give 1,290 as the number of square inches of blast the fan would require. But the square inches of blast = $DW \div 3$. In standard fans of the Sturtevant make W is approximately equal to $D \div 2.4$; therefore,

$$\text{Square inches of blast} = D^2 \div 7.2.$$

Substituting 1,290 for the square inches of blast, we have $1{,}290 = D^2 \div 7.2$, from which D equals 96 inches or 8 feet for the diameter of the fan.

To determine the velocity at which the fan should be run, reference should be made to Table II. For the column coresponding to ¾ ounce it will be seen that an 8-foot fan should run at 178 revolutions per minute to give the capacity required. By increasing the speed at times of overload the pressure and volume of gases can be increased.

In the last column of Table I. is given the horse power required to move given quantities of air, under different pressures and at a temperature of 50° F. per square inch of blast. For forced draft these quantities can be used directly, but it should be remembered that they refer to the theoretical power required to move the air and they should be at least doubled to allow for the fan and engine friction and the power required to run the fan considering it was moving no air and to overcome the friction of the air in the fan casing.

With induced draft the air is of less density on account of its higher temperature, so that less power is required per cubic foot of gas moved. If the gases have a temperature of 600° the quantities given in the last column of Table I. can be multiplied by 0.5, and by 0 58 if the temperature is 450°, to obtain the actual power required to move the air. The engine driving the fan should have its cylinders so proportioned that it can easily develop power 50 per cent. in excess of that calculated.

Table III. shows the capacity of the American Blower Company's fans used for induced draft, according to its catalogue. It is based on a temperature of 550° F. for the gases, and air temperature of 62°, on 18 pounds or 234 cubic feet of air per pound of coal, and a consumption

TABLE I.—*Volume of Air Discharged and Horse Power Required when Air under Given Pressure is Allowed to Escape into the Atmosphere.*

Pressure in Ounces per Sq. In.	Volume of Air Discharged through an Orifice of an Effective Area of Discharge of 1 Square Inch (or per Square Inch of Blast.)	Horse Power Required to Move the Given Volumes Air under Given Conditions of Discharge.
⅛	17.95 cubic feet per minute.	0.00122
¼	21.98 " "	0.00225
⅜	25.37 " "	0.00346
½	28.36 " "	0.00483
⅝	31.06 " "	0.00635
¾	33.54 " "	0.00800
1	35.85 " "	0.00978
1¼	38.01 " "	0.01166
1½	40.06 " "	0.01366
1⅝	42.0 " "	0.15775
1¾	43.86 " "	0 01794

TABLE II.—*Revolutions of Fan of Given Diameter Necessary to Maintain a Given Pressure over an Area which is within the Capacity of the Fan.*

Diameter of Fan Wheel, in Feet.	Pressure in Ounces per Square Inch. ⅛	¼	⅜	½	⅝	¾	⅞	1	1⅛	1¼
3	194	274	336	388	433	475	513	548	581	612
3½	166	235	288	332	372	407	439	469	498	525
4	146	206	252	291	325	356	384	411	436	459
4½	129	183	224	258	289	316	342	365	387	408
5	116	164	202	232	260	285	308	329	349	367
5½	106	149	183	211	236	259	280	299	317	334
6	97	137	168	194	217	238	256	274	290	306
6½	90	126	155	179	200	219	236	253	268	282
7	83	117	144	166	186	203	220	235	240	262
7½	78	110	135	155	173	190	204	219	232	245
8	73	103	126	146	163	178	192	205	218	230
8½	69	97	119	137	153	167	181	194	205	216
9	65	92	112	129	144	158	171	183	194	204
9½	61	87	106	123	137	149	162	173	183	193
10	58	82	101	116	130	142	154	164	174	184
11	53	75	92	106	118	129	140	150	158	167
12	49	69	84	97	108	119	128	137	145	153
13	45	63	78	90	100	110	116	126	130	141
14	42	59	72	83	93	102	110	117	124	131
15	39	55	67	78	87	95	102	110	116	122

TABLE III.—*Induced Draft Capacity Table for Fans.*

Size of Fan.	Diameter Wheel, Inches.	Width at Periphery.	Diameter of Inlet.	Size of Outlet, Inches Square.	Speed R.P.M., for 1-inch Draft.	Capacity of Fan in Cubic Feet per Minute, Temperature Gases 550° F.	Horse Power Boiler Capacity from Fan Capacity.	Pounds Coal per Hour at 5 Pounds per Horse Power Hour.	Brake Horse Power to Drive Fan at Speed.	Capacity of Fan per Inch Width at Periphery.	Horse Power per Inch Width at Periphery.	Cubic Feet Air per Minute for Combustion. Temperature 62° F.
50	30	12⅓	20	18	740	5,030	116	580	2.02	403	.162	2,260
60	36	14¼	23	21½	615	6,900	159	795	2.76	485	.194	3,100
70	42	16½	26	24½	530	9,325	215	1,075	3 72	563	.226	4,200
80	48	17½	30	27	460	11,300	261	1,305	4.50	645	.258	5,100
90	54	20⅝	34	30½	410	15,100	349	1,745	6.03	728	.290	6,800
100	60	23¼	38	34½	370	18,750	433	2,165	7.50	844	.322	8,450
110	66	26	42	37½	335	23,000	532	2,660	9.20	885	.354	10,370
120	72	30½	46	41½	310	29,250	677	3 385	11.72	970	.387	13,200
140	84	34⅝	53	48	265	38,800	896	4,480	15.50	1,132	.452	17,450
160	96	38	60	54	230	49,000	1,130	5,650	19.60	1,290	.516	22,000
180	108	41½	68	60	205	59,900	1,385	6,925	24.00	1,453	.581	27,000
200	120	47	76	66	185	75,500	1,743	8,730	30.25	1,610	.644	34,000
220	132	50	84	72	170	88,600	2,050	10,250	35.50	1,775	.710	40,000
240	144	54	92	78	155	104,600	2,420	12,100	41.80	1,940	.775	47,000

of 5 pounds of coal per boiler horse power. Mr. F. R. Still of the American Blower Company, recently wrote as follows explaining it: "This table gives the diameter of the fan wheel, width at periphery, diameter of the inlet, size of the outlet and the maximum speed necessary to produce a draft of 1 inch of water, which is about the strongest draft that is ordinarily required. The table also gives the capacity of the fan per inch of width (of blade at) periphery, and the horse power per inch of width. If it is desired to run the fan at a slower speed than is given opposite any of our sizes, determine on the speed at which the fan is to run, find the capacity of same per inch width and divide the required capacity for a given horse power in the plant by this capacity per inch and it will determine how wide the fan should be at the periphery, with the increased diameter and the slower speed. The horse power can be determined by multiplying this width by the horse power per inches in width."

[To be Continued]

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, ENGLAND, May 10, 1901.

The Mond Gas Company.—Trade Combinations.—A Libel on the Coal Miner.

The Mond Gas Company is a new undertaking now being promoted for the purpose of supplying cheap producer gas on a large scale, for the use of manufacturers and users of motive power, over an area of about 135 square miles, situated in the Midland District, and covering most of the manufacturing centers for which that district is celebrated, such as Birmingham, Wolverhampton, Stourbridge, Walsall, Dudley, Tipton, etc. The sources of supply are divided into five, the sites selected being in the neighborhood of collieries and, therefore, commanding a large supply of inferior slack coal, which can be had on the spot for about 6s. per ton. This is to be entirely converted into gas, sufficient air being used to convert the whole of the carbon into carbonic oxide, and the residual nitrogen will increase the bulk of the product if it does nothing else. The gas is to be purified and the whole of the ammonia extracted therefrom, and it is claimed that 1 ton of coal will yield nearly 1 cwt. of sulphate, or about four times the yield obtained from an ordinary coal gas works. About three-fourths of the cost of the coal is to be repaid by the sale of sulphate, which reminds one of the story of the Scotchman, who, visiting London for the first time, saw on a notice board outside a cook shop the tempting announcement, "Welsh rabbit, 1½d." This tasty and economical dish is prepared from toasted cheese, but Sandy, reading the statement literally, exclaimed, "I'll have one. Why, I can get 1½d. for the skin." In a similar way, the Mond Company appear to trust to sulphate to pay the cost of the coal, though it would be scarcely safe to speculate on the current price of sulphate, after the enormous output from the five Mond gas stations had settled itself upon the market. The cost of the plant required to carry out the scheme now in view would be, in round figures, £800,000, and when in full operation the daily output would be 84 million cubic feet. The gas is, practically, attenuated coal gas, the diluents being nitrogen and carbonic oxide, and it is to be sold at 2d. to large and 4d. to small consumers. This seems a whimsical distinction that in practice would be attended with much difficulty in the case of users whose consumption flickered under and over the border line. The terms small and large are used in a very different sense to that current amongst gas companies. We should call a user of 1 million per annum a large consumer. But in regard to producer gas, even if in the Mond district he was a small consumer, the cash value of his custom would be only £17 per annum. So that a great deal turns upon whether we consider the quantity of gas taken, or the cash value of the transaction. With such a cheap article, statistics based upon the quantity sold are apt to be delusive and admit of a very extensive showing on a very small foundation, just as electricians, by selecting a small unit, the 8 candle lamp, as a means of expressing their working results, are able to make a very imposing front for a small business. A company who claims to supply over 10,000 lamps may have a gross income of £2,000 or less. So it is better to go straight to the cash returns, and on this head the Mond Company, when in full operation, looks for a revenue of £210,000 from sales of gas and for a net profit of £125,000, or about 15 per cent. So they evidently are looking forward to good times. The promoters disclaim any intention of competing with ordinary coal gas and are willing to accept prohibition clauses against selling for domestic purposes. They look to the large users of power, who at present either employ steam or make their own producer gas, and that without the aid of the profit yielding sulphate. But most of the authorities supplying coal gas in districts within the proposed circle have seen a danger signal, indicating competition in some form or other, in the scheme, and are not pacified by assurances that the gas contains so much nitrogen that it cannot be carburetted and rendered fit for use as an illuminant for flat flame burners, except at a prohibitive cost, and that it cannot be used with the Welsbach mantle, as it clogs the meshes in a very short time by means of a deposit from the gas itself. The supply pressure is to be considerably higher than that usual with coal gas, and in localities where the ground is liable to disturbance, as in the neighborhood of the collieries, steel pipes 30 feet long are to replace the orthodox 12 feet cast iron main pipe. Whereas an ordinary gas undertaking may average an annual rate of 50,000 cubic feet per meter, the Mond Company's ideas on this head are in the neighborhood of 25 millions. Like most other promoters of new schemes, they claim to be benefactors to all and enemies to none. They are going to economize coal by making 1 ton do the work of 5, as at present applied, they will provide an effectual remedy for the smoke nuisance in the form of a cheap, smokeless fuel, they will assist agricultural interests by recovering large quantities of ammonia that at present go to waste, and by providing cheap power will not only strengthen local manufacturers in their struggle against foreign competition, but increase and develop trade in the district and thus enlarge the demand for ordinary gas.

Most of the ordinary gas undertakings in the district belong to local authorities, and it is rather amusing to observe the change of front exhibited by these bodies. Not so very many years ago—the gas supply then being in the hands of private companies—they were loud in their objections to so-called monopolies. And now they are equally loud in claiming protection for themselves. If local authorities will entrench upon the domain of private enterprise, they cannot expect to do so under the shadow of protection, but must be prepared to face the rates of competition and the vicissitudes that are common to all trading ventures. While they will be heard on any points that affect their privileges and obligations as defined by their special Acts of Parliament, they will not be privileged more than an individual or a private company. The probability is that the Mond Gas Company will obtain powers to carry out their present scheme, subject to certain limitations as regards the rights of existing gas undertakings, such as definitions of price, quality, and perhaps minimum consumption per consumer, sufficient to prevent competition as ordinarily understood.

As the Mond Gas Company stands at present, they take up a new sphere of operations quite distinct from that occupied by existing trading ventures. But there is nothing to show that this position will always be maintained. A few steps onward in the progress of invention may put a completely new aspect on the respective positions, for if the small consumer should find that the Mond gas is cheaper or in other ways more capable of supplying his cooking range, his gas fire, and his small engine than the town gas, he will expect to be allowed to transfer his affections from one to the other, if it suits his purpose to do so, and will resist anything in the way of protective legislation, designed for the purpose of bolstering up the interests of the older established concern. The inauguration of the Mond Gas Company is certainly an epoch in British gas industry, and it may eventually lead to the swallowing up or absorption of existing gas undertakings by gigantic individuals of their own species. But there is no stopping the march of progress, and if this prognostication should be verified there will be nothing to do but to bow to the inevitable.

Recent experiences in the coal purchase department must have been sufficient to convince even the most sceptical of gas managers, that there is some advantage in combination amongst vendors of an article in large demand. Where there are 6 sellers and 6 buyers, each is on an equal footing, but where there are 6 sellers and 600 buyers, the sellers have a great advantage. If the gas coke trade was worked on as good an understanding as the gas coal trade, the market value of coke would run 3s. or 4s. more per ton. If gas companies find that they suffer from combinations, as they certainly do, not only in coal but in nearly all their purchases, it seems only reasonable and natural that they should try the system in connection with their sales of residuals. I see that the desirability of united action especially amongst the small fry has been suggested in America. But in the course of a discussion at a recent meeting of the North of England Association of Gas Managers, it transpired that something of the sort is actually in operation in Lancashire. A number of gas managers in the neighborhood of Stockport have made an arrangement to send in

a return of stocks and prices of coke to one of their number who acts as Secretary. These particulars are tabulated and a copy is issued to each member. The returns are sent in twice a month, and the plan has been in operation for a year and is found to be a great help. A man who is acquainted with the stocks and prices at every works within, say, 20 miles, must be in a better position for fixing prices, than one who has only the experiences of one works to guide him. The combination system might also, in the case of small undertakings, be extended to purchases and even to professional advice. Every gas works for example requires wrought iron tube, and one lot of 5,000 feet run could probably be purchased on better terms than ten distinct lots of 500 feet each. One small country works cannot afford to pay a first-class expert. But if 20 such works combined together they could secure services of the best character obtainable. The engineer appointed could make a tour of inspection once a year, and furnish a report either on each undertaking or on the whole, stating his views on the apparatus and the best methods of working it, on the purchase of material and the disposal of residuals, and on such questions as the sale per consumer and the extension of the use of gas.

The advice comprised in a report of this nature would repay the cost over and over again. In these days of improved railway communication one skilled engineer or manager can easily take the oversight of works only a few miles apart. And one qualified individual superintending say half a dozen such undertakings would show better results than if the technical part was left to the best obtainable local talent in each case. The same principle might be applied with great benefit to various branches of extensions and repairs, such as retort settings, main and service laying, etc. By united action the services of a properly trained artisan could be retained, and he would make a much better and cheaper job than the average local bricklayer or ironmonger, to whom such work is usually intrusted.

Just now, our government finds itself called upon to pay a very heavy war bill and the question of additional taxation has created a great amount of discussion lately. It is an easy, cheap and pleasant amusement to shout "Rule Britannia," good exercise for the lungs and gives one an appetite for the next meal. There is nothing to pay for it. But when a little bill of about £5 per head on the whole population is presented for payment as an indirect consequence of the aforesaid musical or possibly unmusical performance, things take a different complexion. One additional tax imposed is a trifling export duty on coal, concerning which strong representations have been made and a threat has been put forward that all the miners will come out on strike if the tax is not repealed. The coal miner is in some respects a misguided individual. He has been patted on the back by one party and another till he believes himself indispensable to the community at large, more important than the army and navy combined, and a hero whose courage and endurance are unequalled in any other sphere of action. He receives about four times the pay of a soldier or sailor and his income is far in excess of the average stipend of a minister of religion, and greater than the earnings of an average shop keeper. But I have a better opinion of his public spirit and patriotism than to believe that he would throw down his tools, in preference to contributing indirectly and in a small way towards the national expenses. There may be some who, having an eye for nothing beyond immediate self interest, think the tax a convenient handle for precipitating such a catastrophe. But to suggest that such is the general view is simply to libel a respectable class of men.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. E. F. SHERMAN has been appointed Superintendent of the new Traverse City (Mich.) Gas Company.

THE Royersford (Pa.) branch of the consolidated Schuylkill Gas Company has established itself in its new offices on Main street. Mr. Mansur, President of the Company, says that for beauty, attractiveness and practicability he will match it against any other gas office "of its size" in the country. The building, which is of brick, is of Colonial design, from the plans of Messrs. Keen & Mead, the well known Philadelphia architects. The front is largely a show window for gas appliances, and the basement is a shop for meter storing, repairing, etc., and "to have and to hold" gas fitting necessaries and the like. The basement also stores the regulators and governors that control the supply of gas received under high pressure from Phœnixville, 5 miles distant. Assistant Superintendent Grander, through whose efforts the Company's consumers have been increased 100 per cent. in little more than a year, is certainly entitled to and will appreciate the increased facilities that the new office affords.

THE stack contracts so far secured by the firm of Adam Weber Sons, of New York and Weber, N. J., rather go to show that the concern made no mistake when it engaged in that line of construction. The contract roster includes the following: Attleboro (Mass) Steam and Electric Company; Beaver Valley Traction Company, Rochester, Pa.; Consolidated Light and Power Company, Whitehall, N. Y.; De Laval Steam Turbine Company, Trenton, N. J.; Glens Falls (N. Y.) Gas and Electric Light Company; Lackawanna Iron and Steel Company, Buffalo, N. Y.—6 stacks; Lackawanna Iron and Steel Company, Lebanon, Pa.—2 stacks; New Amsterdam Gas Company, Long Island City, N. Y.; Nazareth (Pa.) Cement Company; Norcross & Company, Maynard Mass.; Patten Vacuum Ice Company, N. Y. city; Standard Gas Light Company, N. Y. city; Standard Butterine Company, Langdon, D. C.; Steinway & Sons, Astoria, L. I; United Gas Improvement Company, Bridgeport, Conn.; Steubenville (O.) Gas and Electric Company; Worcester and Blackstone Valley Railroad Company, Milbury, Mass; Yorkville Independent Hygeia Ice Company, New York city.

THE American Bridge Company is under contract to furnish all of the bridges required by the Illinois Central Railroad during 1901. This contract means the furnishing of about 3,000 tons of steel.

"W. F.," writing under date of the 20th inst., says: "The annual meeting of the Bangor (Me.) Gas Light Company does not seem to bear out the prediction that the Company was likely to change hands; for the election of Directors resulted in the naming of Messrs. T. U. Coe, A. C. Hamlin, L. W. Cutter, J. P. Bass and F. H. Small. The Directors later on organized as follows: President, A. C. Hamlin; Treasurer, George A. Crosby; Clerk, C. M. Griffen; Superintendent, C. E. Dole; Asst. Supt., V. K. Gould.

MESSRS. F. H. SHELTON and R. D. Apperson, owners of the Lynchburg (Va.) Gas Company, have recently acquired the Lynchburg and Rivermont Street Railway Company and the Lynchburg Electric Railway and Light Company, and, under date of May 1st, merged the three properties into a new concern bearing the title of the Lynchburg Traction and Light Company. The officers of the new Company are: President, R. D. Apperson; Secretary and Treasurer, F. H. Shelton—the same as of the Gas Company heretofore.

THE proprietors of the Lowell (Mass.) Gas Light Company have announced a reduction in the selling rate of 10 cents per 1,000 cubic feet, the same to become effective October 1, 1901. This means that Lowell is to have gas at 90 cents per 1,000.

MR. F. H. SHELTON and certain associates, under date of May 1st, as heretofore announced in the JOURNAL, have purchased all of the stock of the Columbia (S. C.) Gas Light Company, as well as the interest of the United Gas Improvement Company in a lease under which for some years the latter Company has operated the plant. Columbia is the capital city of the State, and in the past few years has developed large manufacturing interests. Its growth, since the census of 1890, has been nearly 50 per cent., and its present population is about 25,000. The gas plant will be nearly doubled in capacity, contracts having been let for new benches, holder, meter, scrubbing and condensing apparatus, etc. Extensive additions to the street main system will also be made. No substitution will be made in the local management, the new owners having determined to keep in control thereof Mr. John M. Daniels, whose conduct of the Company's affairs in the past had been eminently satisfactory. The advent of the new management will be signalized by an announcement of a material reduction in the selling rates, to date likely from the 1st prox.

THE official announcement of the reduction in the selling rate by the New Britain (Conn.) Gas Light Company is out. Under the regulation the gross is put at $1.50 per 1,000, prompt payment (within 10 days) to secure a rebate of 10 cents per 1,000. The schedule goes into effect July 1st.

AT the annual meeting of the Lawrenceburg (Ind.) Gas and Coke Company a 7 per cent. dividend was declared. The executive officers chosen were: President, Omar T. Stockman; Vice-President, John Stancomb; Treasurer, George M. Roberts; Secretary, James W. Isherwood; Asst. Secy., Thos. W. Isherwood.

MR. T. R. JACOBS is informed that the latest semi-annual dividend (4 per cent.) declared by the Brooklyn (N. Y.) Union Gas Company is payable the 1st prox.

THE Legislature of Connecticut has assented to the petition of the proprietors of the Windsor Locks Electric Light Company to permit them to engage in the manufacture and sale of gas.

AT the annual meeting of the Gloucester (N. J.) Gas Light Company, the properties of which have, as was reported in the JOURNAL heretofore, been taken over by the South Jersey syndicate, Mr. Henry B. Chew, who had served the Company as Secretary and Superintendent since 1866, tendered his resignation.

AT the annual meeting of the Fort Plain (N. Y.) Gas and Electric Light Company the selling rate was ordered put at $2 per 1,000 cubic feet for all uses and for all quantities. Hitherto the rates were: $3 where the consumption was less than 1,000 cubic feet per month; $2.50 per 1,000 in excess or beyond that quantity. The Company proposes to make a fair try for extending the use of gas this summer on cooking account. The Directors elected were: Messrs. Andrew Dunn, William Yerdon, William E. Diefendorf, L. M. Weller and J. L. Moore.

MR. BENJAMIN J. MACDONALD, of New York, has purchased the plant and franchises of the Bristol (Tenn.) Gas and Electric Company, and he proposes to expend quite a bit of money in developing the business of the concern on modern, or northern, lines. The clever gentleman named is by no means a novice in the gas business, he, as Secretary-Treasurer and Superintendent of the old Consumer's Gas Company, of Newburg, N. Y., having put in many years of successful work in connection with its fortunes. The best of good luck to him in his new field of labor. He will be President and General Manager of the Bristol Company.

ALL signs that may be read point to the amalgamation of the electric lighting interests of Boston this summer, with the Edison Company as the absorber.

THE Clyde (N. Y.) Gas and Electric Company is again supplying light to its patrons, which service was interrupted through the destruction of its plants last March by fire.

THE new gas works at Manitowoc, Wis., will be in active operation by July 1st; at least so Manager Bates says.

THE City Councils of Reading, Pa., have declared their intention of "obliging" the Consumers' Gas Company of that city to put its selling rate for illuminating use at $1 per 1,000 cubic feet.

THE Phœnix Gas Improvement Company, of Philadelphia, it is said, will construct a water gas plant this summer for the proprietors of the Latrobe (Pa.) Gas Company.

THE Kansas City (Mo.) Gas and Electric Light Company has been formally put out of chance to do business through the action of its Directors. It was an opposition concern, but no attempt to go ahead under its charter and franchise was ever made.

THERE is little doubt that the proposed gas works for Shelby, O., is to be shortly an accomplished fact. The name of the concern is the Shelby Gas Company, and its officers are: Directors, B. J. Williams, J. A. Seltzer, Edwin Mansfield, W. J. Wilkinson, M. H. Davis, J. C. Fish and Roger Heath; President, B. J. Williams; Vice-President, J. A. Seltzer; Treasurer, W. J. Wilkinson; Secretary, Edwin Mansfield.

MR. J. T. BAKER has been named to take charge of the gas plant at Riverton, N. J. He was formerly manager of the Nebraska City (Neb.) Company.

The ordinance under which Charles V. Newman and others proposed to operate an opposition concern in Peoria, Ills., to be known as the Citizens Gas Company, has passed away. The cause for the lapse was the failure of the promoters to put up a $5,000 cash guarantee in the time specified.

THE proprietors of the Mansfield (O.) Gas Light Company will largely extend its main system this summer. The extensions now arranged for should have been made 5 years ago. However; better late than ever.

IT is said that the Lachine Rapids Hydraulic and Land Company contemplates the construction and operation of a gas works in Montreal, Canada, in opposition to the existing Montreal Light, Heat and Power Company. The obstacle to the realization of such hope lies in the seeming difficulty of securing a franchise. The water and land jammers say they will sell gas in Montreal for all purposes at 75 cents per 1,000 cubic feet. They will—to morrow.

THE proprietors of the Mankato (Minn.) Gas and Electric Light Company, in order to foster the sale of gas for cooking purposes, have put the rate on that account and use at $1.50 per 1,000 cubic feet. The Company also agrees to put down services and make connections free of charge.

THE Somerset Lighting Company, of Somerville, N. J., has arranged to extend its pipes into and through the Bound Brook district.

MESSRS. E. E. MORRELL and Irwin Rew, heretofore respectively Vice-President and Secretary-Treasurer of the Cicero Gas Company, of Oak Park, Ills, have resigned. The former is succeeded by Mr. T. M. Jackson; the latter by Mr. Richard Rees. Mr. N. A. McClary continues as the Company's executive officer. Mr. Rees will likely be the active man in the Company.

MR. H. H. STEPHENS, of Macomb, Ills., has been granted a franchise for the construction and operation of a gas plant in Brookfield, Linn County, Mo. A special election was called for a proper expression of the sentiments of the residents over the proposition. Votes to the number of 501 were cast, 496 of which were in favor of the project.

THE Committe on Fire and Lighting of the New Orleans (La.) City Council has reported adversely on what is known locally as the Badger gas ordinance. It was an opposition scheme.

A CORRESPONDENT forwards the following from Birmingham, Ala., under date of the 22d inst.: Some days ago Ald. Heidt, of the Light Committee of Councils, presented a petition from Messrs. C. Bradshaw, E. N. Cullom, C. R. Brodix and others for a franchise to construct in this city a gas plant by a concern to be known as the Consolidated Bi Product Gas Company. The franchise sought gives the Company the right to use the streets, avenues and alleys in laying mains. An ordinance is framed up in the petition which requires that the illuminating gas shall be full 16-candle power and the prices shall be as follows: For gas furnished the city: Illuminating, $1 per 1,000 cubic feet; fuel purposes, 65 cents per 1,000, with 10 per cent. off. For gas furnished private consumers: Illumination, $1 per 1,000, and for fuel, 65 cents per 1,000, without reduction. The Company is allowed to make contracts with owners and proprietors of hotels, theaters, shops or public houses or public places of any kind at a less price than it may charge private or smaller consumers. The franchise provides that the construction and operation of said gas plant and pipe lines shall at all times be governed and controlled by specifications and direction of the city engineer, as to grades, crossing and also as to the surface, in so far as the streets may be affected. Before any work is begun the Company shall furnish the city of Birmingham with proper bond or surety to pay all such damages as may be sustained by the city or any private persons by reason of any wrongful action of the Company. One clause reads as follows: Be it further ordained, That the Mayor is hereby authorized, empowered and required to enter into contract with the Consolidated Bi-Product Gas Company, a corporation to be organized under special charter act of the Legislature of Alabama, approved February 15, 1901, within 90 days after the passage of this ordinance, which contract shall embrace in detail the several provisions hereof, and said contract shall be of force during the term of 30 years from and after its date. The annual license of the corporation during the term of 30 years shall not exceed $500 per year. The petition was referred to the Light Committee.

THE Lawrence (Mass) Gas Light Company will be supplying gas in the adjoining town of Andover by the 1st prox.

THE proprietors of the Springfield (Mass.) Gas Light Company have determined to discontinue the supplying of steam heat in both the business and residential districts of that city.

THE Bellevue (Ky.) gas works have been closed, the supply to that section being sent directly from the works at Covington, Ky.

The Market for Gas Securities.

The market for city gas shares was quite erratic during the week. In the early part strength was the feature of Consolidated, later on quite a bit of weakness was developed in it, but towards the close a return to the higher level was made. To-day (Friday) it opened at 217, bid, and at the close 219 was bid. Trading in the shares was comparatively light. Next Friday is the time for declaring the dividend, and while it is not likely that anything in excess of the regular 2 per cent. will be ordered, it is not impossible that some sort of an announcement regarding the absorption of other properties will be made. The business that the Company is doing is little short of wonderful.

Brooklyn Union is consistently strong, as it should be, but the ruling price is far below that which it will eventually reach. Its closing to-day was 215 to 220. Peoples, of Chicago, fairly holds its own, and the same may be said of Baltimore Consolidated. Washington (D. C.) gas is again on the upward flight. As a whole, the gas share market presents no distressing features in respect of investment account, or for purchase on the long side.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 Wall Street, New York City.

May 27.

☞ All communications will receive particular attention. ☜ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	219	220
Central Union, Bonds, 5's.	3,000,000	1,000	106½	107
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	120	..
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	310	320
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	
New Amsterdam Gas Co. Bonds, 5's	11,000,000	1,000	108¼	109
Northern Union, Bonds, 5's.	1,250,000	1,000	106	108
New York and East River Bonds, 1st 5's	3,500,000	1,000	111	115
" 1st Con. 5's	1,500,000	..	106	108
Richmond Co., S. I.	348,650	50	70	..
" Bonds	100,000	1,000		..
Standard	5,000,000	100	135	.
Preferred	5,000,000	100	155	160
Bonds, 1st Mortgage, 5's	1,500,000	1,000	110	114
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	216	22
" " Bonds (5's)	15 000,000	1,000	118	11
Bay State	50,000,000	50	¾	⅞
" Income Bonds	2,000,000	1,000	.	75
Binghamton Gas Works	450,000	100	26	30
" 1st Mtg. 5's	500,000	1,000	92½	95
Boston United Gas Co.— 1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	6	10
" " Bonds, 5's	5,250,000	1,000	75	76½
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	
Central San Francisco	2,000,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati G. & C. Co.	8,500,000	100	209½	210
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	106	107
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	60	65
Preferred	3,026,500	100	84	86
Consumers, Jersey City Bonds	600,000	1,000	102	103
Consumers, Toronto	1,700,000	50	215	216
Consolidated, Baltimore	11,000,000	100	60½	61
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	12½	14½
" Con. Mtg. 5's	880,000	1,000	81½	83
Consolidated G. & E. Co.'s, Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co.	4,825,500	50	.	89
" Prior Lien 5's	5,603,000	1,000	99½	100
Detroit Gas Co., 5's	381,000	1,000	..	89
" Inc. 5's	16,000	100	94	94½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	35	40
Fort Wayne	2,000,000	..		.
" Bonds	2,000,000	..	53	55
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	103	104
Hartford	750,000	25	240	250
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	60	68
" Bonds, 6's	2 650,000	..	97	97½
Jackson Gas Co.	250,000	50	70	75
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	101½	103
Laclede, St. Louis	10,000,000	100	83½	84
Preferred	2,500,000	100	99⅛	101
Bonds	10,000,000	1,000	..	108½
Lafayette Gas Co., Ind.	1,000,000	100		60
Bonds	1,000,000	1,000	60	66
Louisville	2,570,000	50	110	120
Madison Gas & Elec. Co. " 1st Mtg. 6's	350,000	1,000	102½	108
" 6 per cent. scrip, due 1910	100,000	25	87	89
Montreal, Canada	2,000,000	100	182	184¾
Newark, N. J., Con. Gas Co	6,000,000	..	..	55
Bonds, 6's	4,600,000	..	..	103
New Haven	1,000,000	25	280	300
Nashville Gas Lt. Co.	1,000,000	50	110	..
Oakland, Cal.	2,000,000	..	46	47
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	114¼	114½
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90

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DIVIDEND NOTICE.

OFFICE OF THE AMERICAN GAS COMPANY,
222-224 S. THIRD ST., PHILA., PA., May 15, 1901.

The Board of Directors of The American Gas Company has this day declared a semi-annual dividend of 3 per cent., or $3 per share, on the capital stock of the Company, payable on and after June 1, 1901.

1354-2 R. L. BABCOCK, Secretary.

Position Wanted.

A MAN, 25 years of age, desires a position as Assistant Superintendent of a gas works. Can test, set, repair and read meters, lay mains, run services, connect gas stoves, make lead connections and do gasfitting. Quite up to attending to any kind of complaint work. Understands manufacture and distribution. Best of references.

1355-1 Address, "V.," care this Journal.

Position Wanted

As Superintendent of Gas Works.

By a man who, for the last 17 years, at different times, has worked on a salary, leased and owned interests in gas works. Can give the best of references. Address,

1355-4 J. M. HUME, Macomb, Ills.

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AS FOREMAN OF GAS PLANT.

A married man, 35 years of age, who has had charge of a gas plant for 8 years, and knows all about street mains and services, would like to make a change from his present position. The best of references furnished.

Address, "FOREMAN,"
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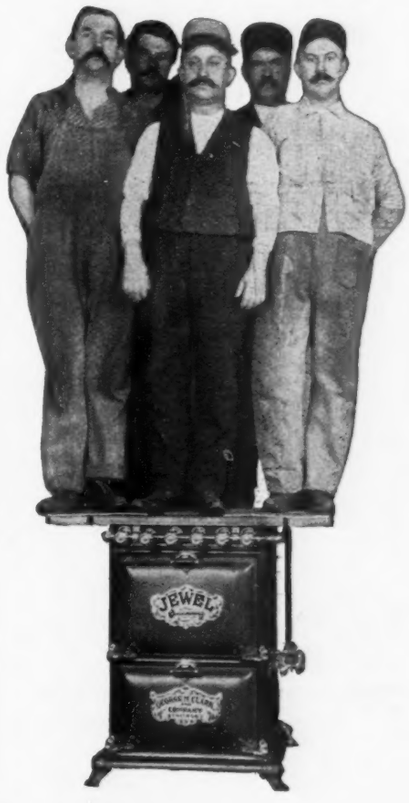

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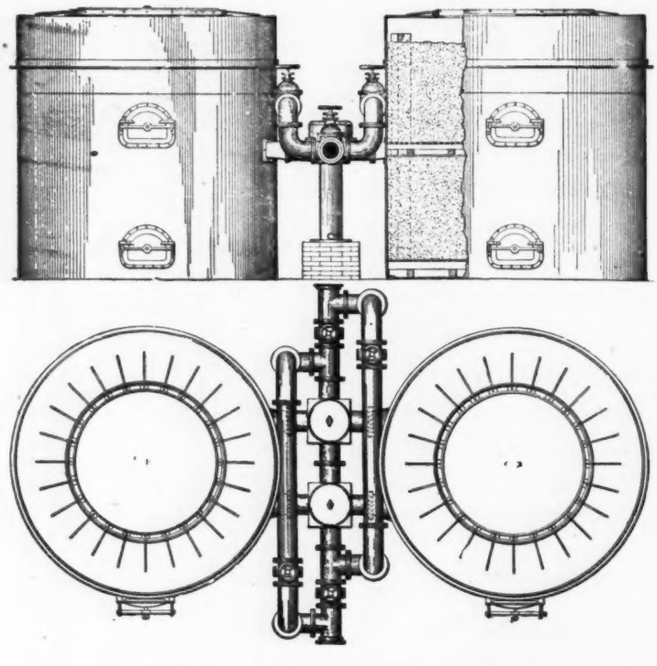

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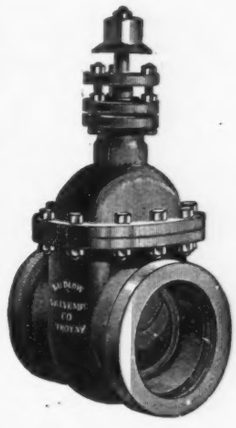

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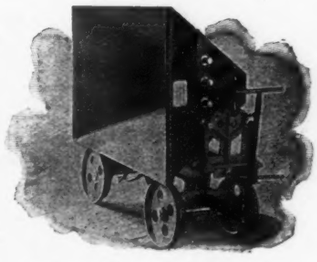

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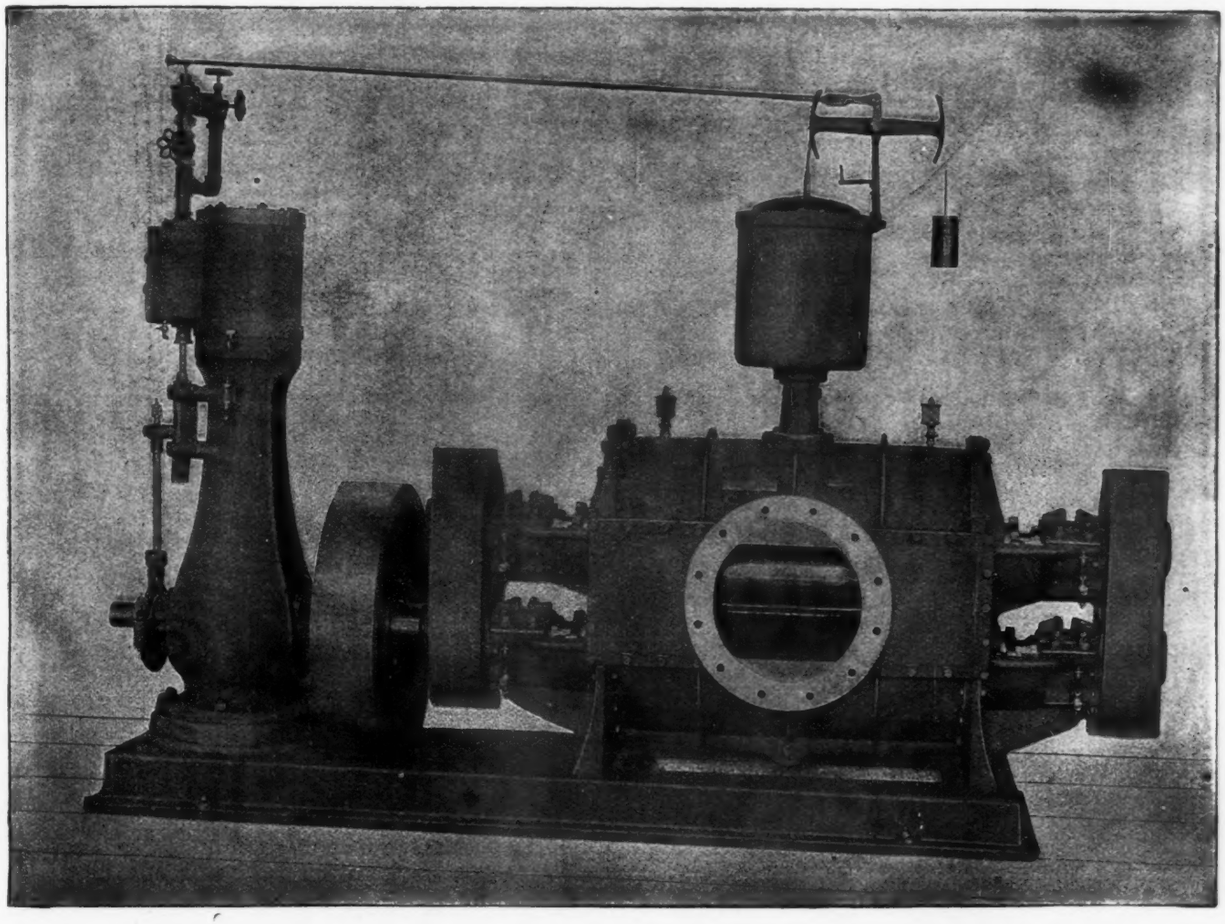

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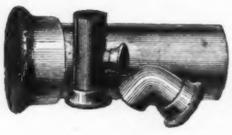

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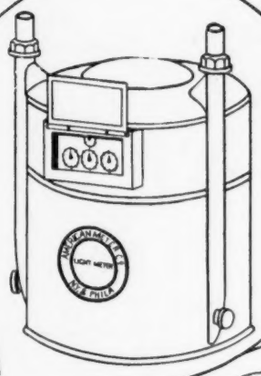
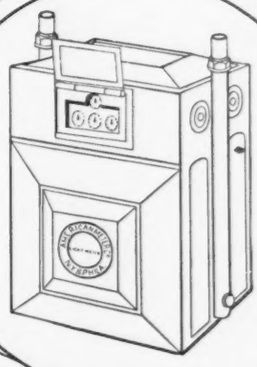
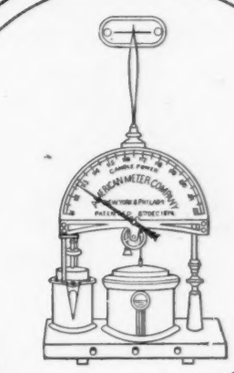


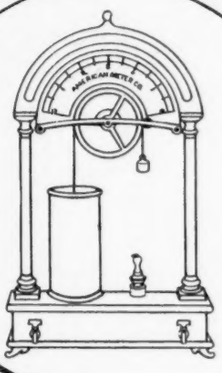


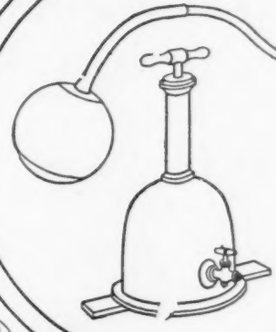
PUBLIC LIGHTING TABLE.

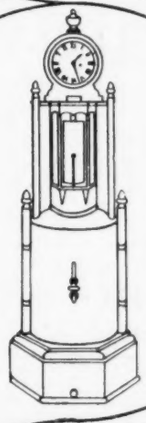
JUNE, 1901.

Day of Week.	Table No. 1. Following the Moon. Date.	Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Sat.	1	No L. FM	No L.	7.15	3.15
Sun.	2	No L.	No L.	7.15	3.15
Mon.	3	7.50 PM	9.30 PM	7.15	3.15
Tue.	4	7.50	10.10	7.25	3.15
Wed.	5	7.50	10.50	7.25	3.15
Thu.	6	7.50	11.30	7.25	3.15
Fri.	7	7.50	12.00	7.25	3.15
Sat.	8	7.50	12.40 AM	7.25	3.15
Sun.	9	8.00 LQ	1.10	7.25	3.15
Mon.	10	8.00	1.40	7.25	3.15
Tue.	11	8.00	2.20	7.25	3.15
Wed.	12	8.00	3.00	7.25	3.15
Thu.	13	8.00	3.30	7.25	3.15
Fri.	14	8.00	3.30	7.25	3.15
Sat.	15	8.00	3.30	7.25	3.15
Sun.	16	8.00 NM	3.30	7.25	3.15
Mon.	17	8.00	3.30	7.25	3.15
Tue.	18	8.00	3.30	7.30	3.15
Wed.	19	8.00	3.30	7.30	3.15
Thu.	20	8.00	3.30	7.30	3.15
Fri.	21	9.50	3.30	7.30	3.15
Sat.	22	10 20	3.30	7.30	3.15
Sun.	23	10.50 FQ	3.30	7.30	3.15
Mon.	24	11.20	3.30	7.30	3.15
Tue.	25	11.50	3.30	7.30	3.15
Wed.	26	12.20 AM	3.30	7.30	3.15
Thu.	27	1.00	3.30	7.30	3.15
Fri.	28	1.40	3.30	7.30	3.15
Sat.	29	2.30	3.30	7.30	3.15
Sun.	30	No L.	No L.	7.30	3.15



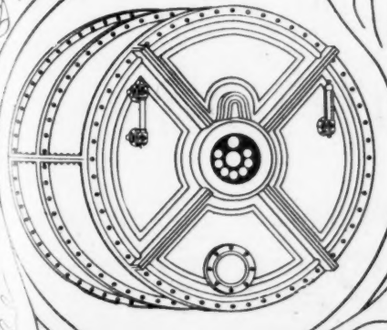


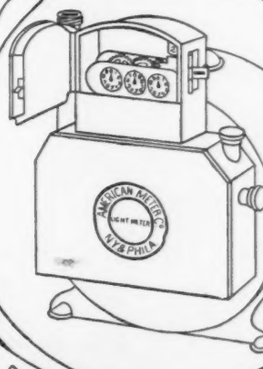




TOTAL HOURS LIGHTING DURING 1901.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	220.10	January	423.20
February	192.30	February	355.25
March	180.00	March	355.35
April	158.30	April	298.50
May	140.40	May	264.50
June	135.40	June	234.25
July	138.00	July	243.45
August	156.20	August	280.25
September	174.40	September	321.15
October	202.30	October	374.30
November	220.40	November	401.40
December	241.30	December	433.45
Total, yr.	2161.10	Total, yr.	3987.45





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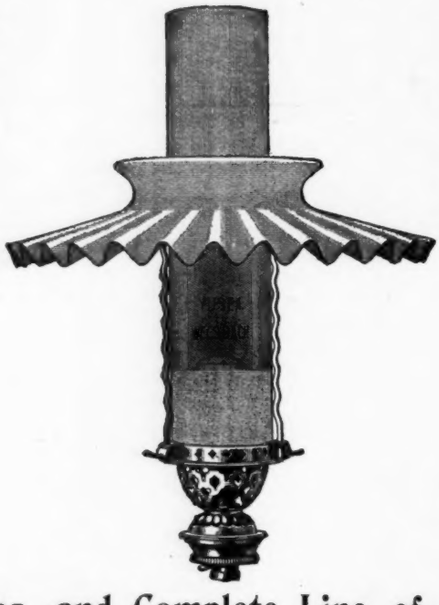

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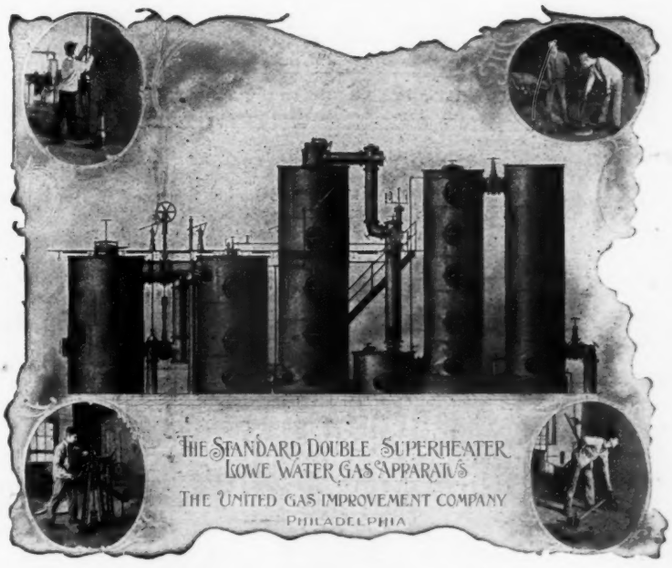
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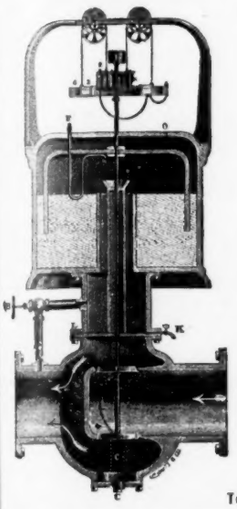

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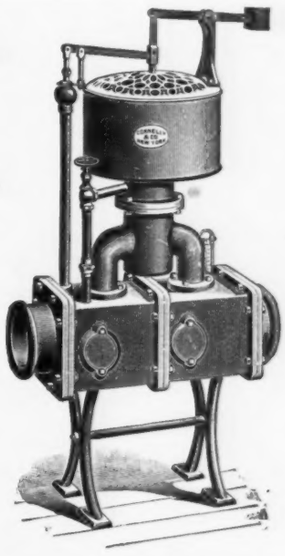

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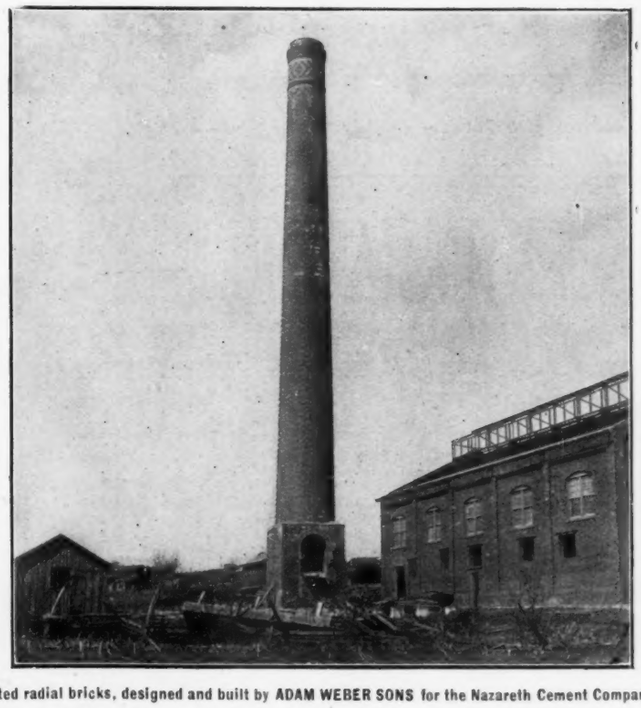

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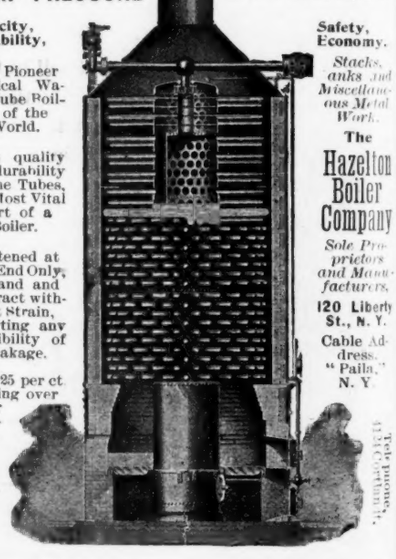

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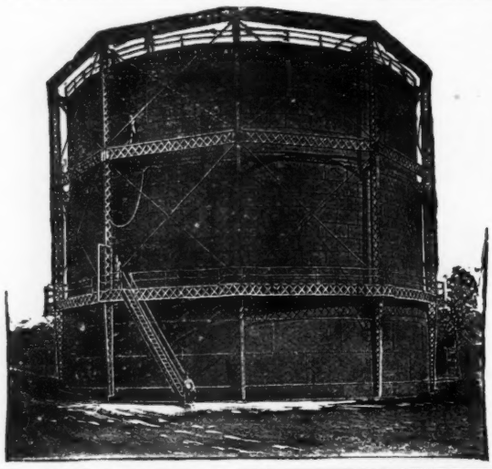

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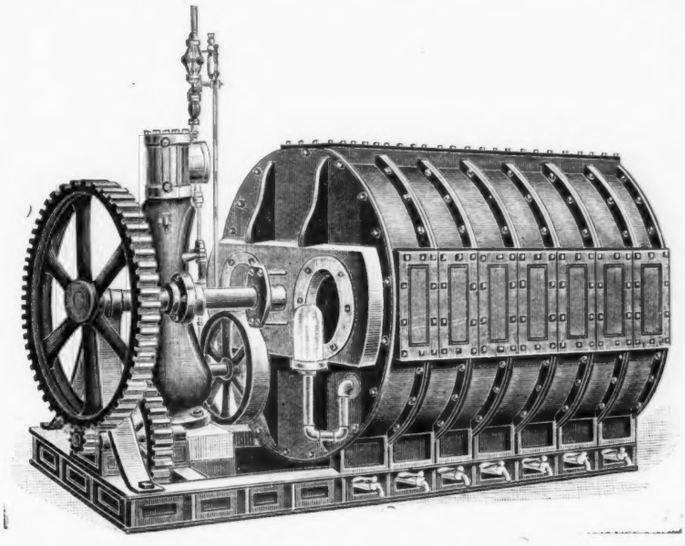

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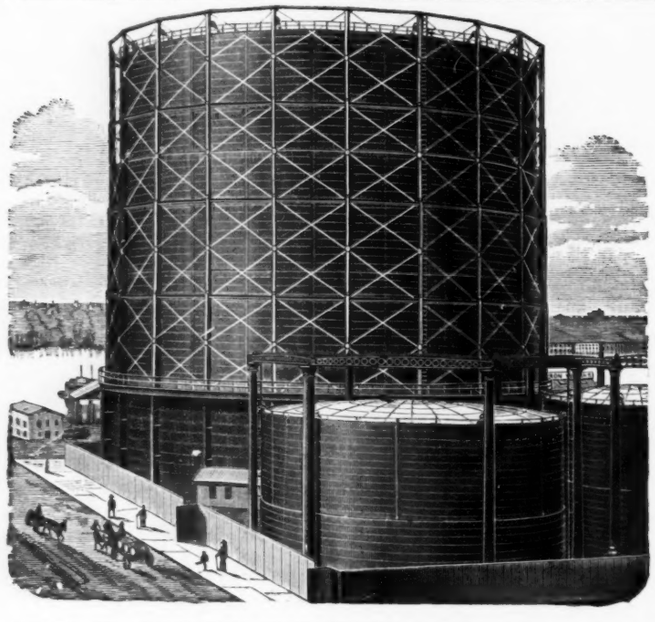

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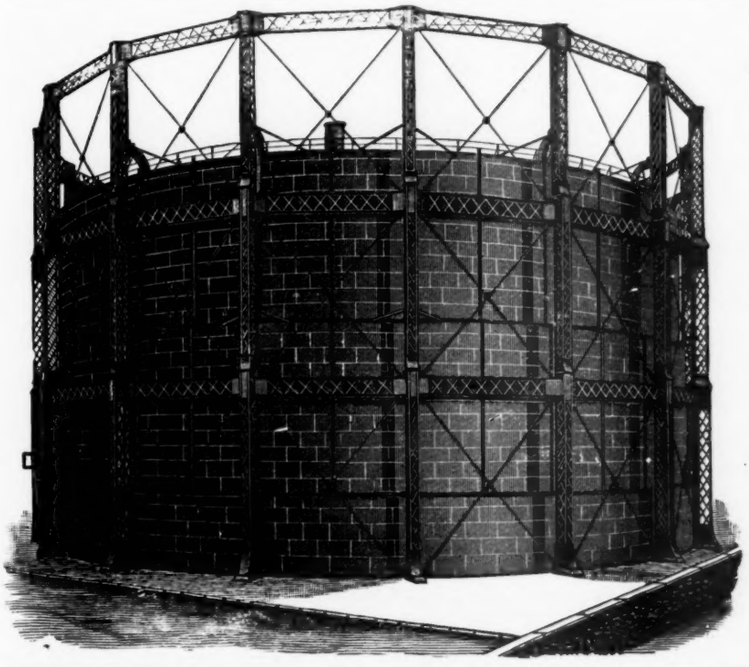

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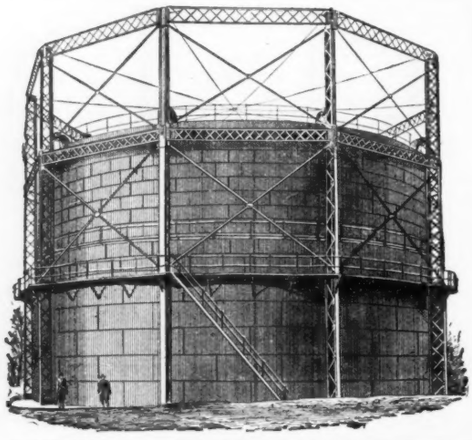

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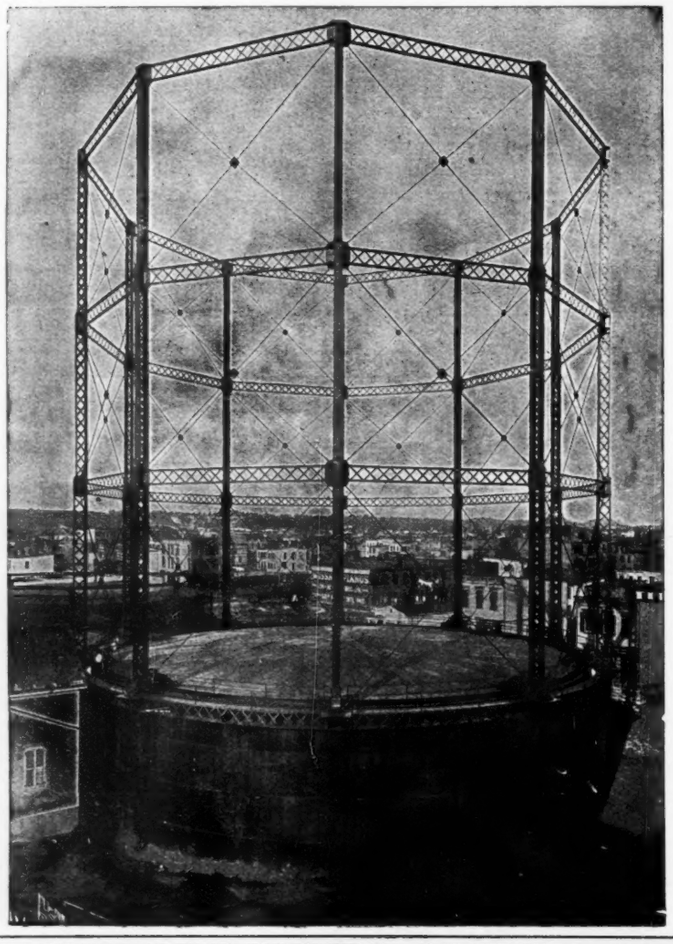

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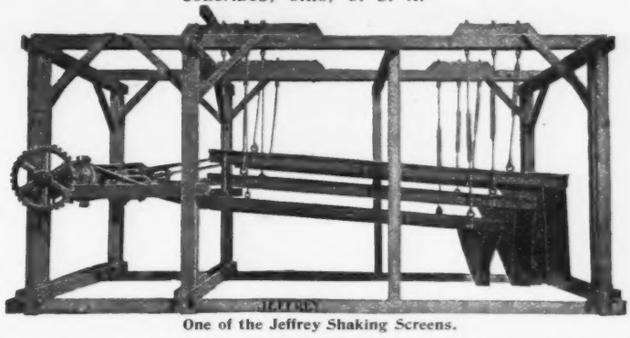

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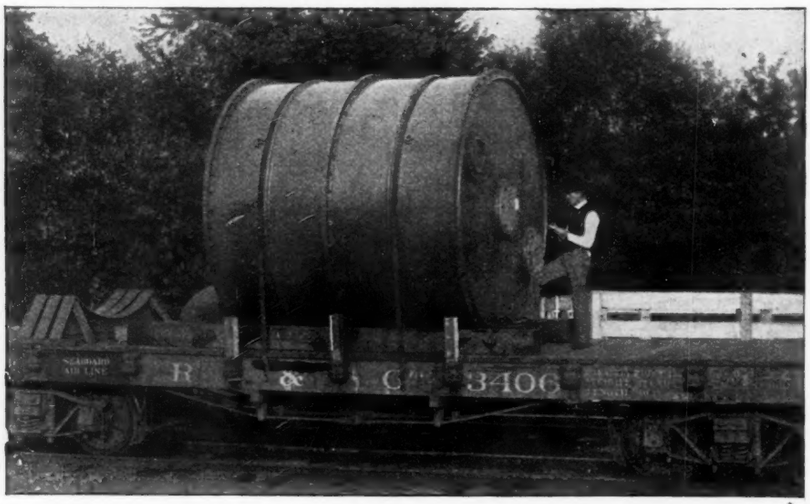

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